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THE

AMERICAN NATURALIST.

VOL. XXII. MAY, 1888. No. 257

GUATEMALA FORESTS.

BY MILES ROCK.

IN a general view over the surface of Guatemala we observe a great difference in the character of the vegetable covering. Little of this difference can be due to change in latitude, as the whole Republic lies within the parallels of 13° 44′ and 17° 49′, or extends only about 4 degreees north and south. In longitude, it lies between 78° 8′ and 92° 10′ west of Greenwich, or extends also 4° east and west. Roughly it is in the form of a square, of which these dimensions of 4° are the diagonals. This country is the northwestern one of the five Central American republics, and covers about one-fourth of their entire area, and is about as large as the State of Pennsylvania, 43,000 square miles, but has hardly one-third the number of inhabitants — say one and one-third millions.

What, then, are the causes of the plant diversity? They are, undoubtedly, 1st, elevation above sea level; 2d, meteorological influence of topographical features on climate; and 3d, influence of the ancient inhabitants. The first I take to be the most important cause. We have first the hot climate of the coasts, extending from sea-level to altitudes of 3000 feet, and including

(*a*) The Pacific Coast plain, some 40 miles wide and 135 long, covering 4500 square miles.

(*b*) The Caribbean Sea Coast plain, some 60 by 20 miles, including the valleys of the rivers Sarstun, Dulce, Polichie, Matagua and Zacapa, and Lake Yzabal, or Golfo Dulce, covering 3200 square miles.

(*c*) The Gulf region, or part of the great plain entering northward from the Sierra Madre, or Cuchumatanes Mountains to the Gulf of Mexico, about 150 miles square, including (1) the basin of the river Neumacinta and its four great affluents, the rivers San Pedro, Lacantun, Chixoy and Pasion, and the narrow valleys of their upper branches, covering some 16,000 square miles; (2) the valleys of the Lagartero and Salegná rivers, 250 square miles; and (3) the valley of the Cuilco River, 50 square miles, the last three rivers being the upper affluents of the Chiapas River, all these regions together making 24,000 square miles of *tierra caliente*, or more than one-half the entire country.

Secondly: A great mountain system running nearly east and west from the Isthmus of Tehuantepec to the Gulf of Honduras occupies the middle of Guatemala between the Pacific and the Gulf plains, in a succession of axes of elevation, vaults and escarpments, overlapping or arranged *en echelon*. In some ten places these mountains attain elevations of 10,000 to 12,000 feet, and elevations 8000 to 9000 feet are numerous. Between these are the many deep erosion valleys, pre-tertiary, which, in the eastern and northern parts of the country, are in the low, hot lands, but in the western and southern parts are filled in with volcanic debris, some trachyte, but mostly ashes, forming extensive and curiously level plains, surrounded by high mountains. These ash plains are from 5000 to 7000 feet above the sea, and form the larger part of the temperate region, or *tierra templada*, and are the sites of most of the cities and large towns, the seat of most of the population, and mostly cleared and cultivated, now and since remote times, as shown by ancient remains. These plains are often traversed by impassable barrancos, or ravines with vertical sides eroded through the ash beds since Pliocene times, by small swift rivers, often to depths of 300 or 400 feet.

The temperate regions, from 3000 to 9000 feet above the sea, cover about 15,000 square miles, or one-third of the whole surface of the Republic.

Thirdly: We have the remaining one-tenth of the country, or 4000 square miles, rising above 9000 feet, and in at least two table lands, those of Ixchignan and Chémal, extensive table lands at 11,000 and 11,500 feet, and which are traversed by ridges 1000 feet higher, and finally, there are six volcanic cones attaining from 13,000 to 14,000 feet elevation.

I have one comment more to make on the face of the country to complete the view, as the matter is usually misunderstood. The twelve or more volcanoes of Guatemala, of which only two show a slight activity, do not form the culminating points of its mountain masses, but are seated on the southern slopes, facing the Pacific, shooting up in beautiful symmetrical cones, with straight slopes almost from the sea-level to the point, looming up, viewed from the Pacific, in solitary grandeur, 3000 feet above the lofty sierras behind them. It is one of the great and inspiring sights of the world to thus see close together the three cones of Agua, Fuego and Acatenango, and the Spaniards could not help but place them on the escutcheon of Guatemala as the symbol of this beautiful land.

Let us begin at the top of one of these towering, awe-inspiring volcanoes, 14,000 feet above the sea, as Agna, or Tajumulco or Tacaná, and take a general view of the vegetation on our way down to the sea-level. On Tajumulco I spent two days and on Tacaná eight, to make observations. It was bitterly cold, day and night, reaching 8° F. above zero. The piercing winds blew at times so one could hardly stand up. Large lava stones were piled against the tripod to keep the theodolite from falling over. Hail storms, with terrific lightning and crashing thunder enveloped us. Owing to rarity of air some of the people became sick and had to be sent down. The volcano was extinct (Tajumulco), but several acres of calcined and crumbling rock, and fissures and holes lined with sulphur crystals and incrustations show that not many years ago it burned. On a part of the crater rim were stuck many crosses and notched sticks where the Indians come to perform their ancient religious rites. On Tacaná two *Chinams* (priests) came up and performed a sacrificial rite with a turkey in my presence after I convinced them that I was from another country and would not betray them, for such rites are forbidden. The view extended over the coast plain and many miles over the Pacific to an indistinguishable horizon, where sea and sky blended; but at sunset one could see where it came, apparently up in the sky.

Round about the crater was only sterile desolation, but on descending one soon sees dry grasses, low weedy herbs and stunted pines and cedars. From 500 to 1000 feet below begin pine forests that extend down to 9000 feet above sea-level. There are

also other trees and shrubs and flowers, the last mostly at the top of precipices, the sides of waterfalls, or wherever the sun can get to the ground.

In tropical woods there is not such a profusion of beautiful flowers as in the colder climates; they are too meek and lowly, can get no sun, and are choked out. I have noticed that where trees can get no hold, as on precipices, the rocky banks of rivers, or on narrow promontories jutting into lakes, a great variety of flowers occur; also in abandoned mountain meadows, where the ancient people cleared the forests away, I have noticed ranunculi, violets, geraniums, fuchsias, begonias, compositæ, lilies, whortleberry, abutilon malvas, the wild dahlia, and a host of others.[1] This general shutting out of the sun from the ground accounts not only for the lack of wild flowers, but also for the striking abundance of twining and climbing plants. On the higher volcanic slopes are many vines, and among others a blackberry and a tomato that go straight up to the tops of the highest trees before they branch out and spread their leaves to the sun. The way to gather berries of both is to cut down the trees, and when a tree falls the Indians run to where the tree-tops land, to get the berries.

At places where large wet surfaces of lava have no covering of soil, they are carpeted over with thick beds of mosses and ferns. In descending the volcano Tacaná, when I first came to such an open place without knowing its character, I began to slide with the green carpet, and, there being no bushes to take hold of, kept on at a dangerous pace until a fallen trunk stopped the avalanche.

The trade winds from the Caribbean Sea bring such abundance of moisture that all summits and slopes exposed to them are incessantly enveloped in mists, and the woods are dripping as with rain. These are also the regions of heaviest rainfall during the rainy season. Owing to this excessive moisture one finds the great tree-fern growing at exceptional altitudes, at 9000 feet and over, above the sea. They attain a height of twenty to thirty feet, and a diameter of trunk of even one foot, and occur in greatest abundance on the north slopes of the volcano Tacaná.

From 11,000 to 8000 feet is truly the forest region, characterized by great variety and heavy growth. There are many hard woods, of

[1] But orchids, epiphytes and other flowers, as well as ferns, mosses and lichens whose habitat is on trees, abound universally throughout the forests and at all elevations, but varying in species.

beautiful colors, as bright yellow and rosy red, that would be most valuable for cabinet-making were they accessible, but to bring them out would be too costly.

I have mentioned the pine already. There are at least three species. One is the *Ocóte*, which is very rich in resin, and is used all over the country for light. In every hut three stakes, or a three-forked stake, is driven into the earth floor; a flat stone, or water-jar, is placed on top about three feet from the ground, and on this a few finely-split sticks of *Ocóte* are kept burning, and a child has the duty of replenishing it from time to time with fresh sticks.

I have seen mule-loads of these split sticks on the way to city markets, and in Guatemala city the *Ocóte* sticks hold their own against the electric light. In the low country, in districts where no *Ocóte* grows, some trunk discovered on a river bank, borne down from the mountains by freshets, is a treasure, and supplies the inhabitants with light until it disappears piecemeal. This pine grows at all elevations in the temperate and cold climates, and is the characteristic tree on the volcanoes, on the ash beds, but here mostly cleared away except in barrancos, and in sandstone soil. There are also some remarkable pine forests near the sea-level. We thus see the pine growing from sea-level to the highest summits, and on the volcanoes to over 13,000 feet high, either in exclusive forests or mixed with other trees. There is a species of pine that is of rare occurrence in the temperate belt. It is called the "holy pine," but I have not learned the reason. Perhaps because crosses can be easily cut from the limbs, from its regular opposite branching. Its needles are very long, and bark smooth.

There is a curious tree belonging to the order of the Compositæ that is confined to a particular elevation in a marked way. It is rather gnarled and crooked in shape, but with trunks over a foot in diameter, and reaching a height of thirty feet. Its leaves are willow-shaped, nearly a foot long, glossy green above and white tomentose beneath, and clustered at the end of the branches. The flowers are yellow, sunflower-like, an inch or more across, and arranged in large racemes. This tree is so entirely wanting at lower levels, and so regularly makes its appearance at 10,000 feet above the sea, that we call it "our 10,000-footer." It hardly extends 1000 feet in vertical range. At these elevations occurs another

curious tree looking like a gigantic laurel bush, much twisted, gnarled and recumbent, with a smooth red bark, peeling off like the buttonwood.

Another tree of limited range is the *Pinabete*, a spruce. I have noticed it on the Pacific side, at elevations of 9000 feet. It has given its name, *Pinabete*, to a range of mountains on which it is common.

At the upper limit of the temperate belt begins the occurrence of the cedar, or cypress, a lofty tree of large diameter, forming an extensive forest on the table land of Serchil, east of the volcano Zajumulco. In single trees and groups it occurs on many mountains, and especially in the great steep mountain ravines. This tree is much used by the natives in their constructions, being so easily worked. It is especially used for making planks. These are made by edging a section of a trunk of proper length on opposite sides until the finished plank remains. The trees are of such diameter that a single width serves for benches, tables and doors.

A cedar, perhaps a different species, grows in the hot country, and is used to make *cayukas*, or dug-out canoes, and oars. They are light and durable, and large trunks make canoes that carry many people or heavy loads of corn or salt, perhaps four or five tons. They are very sea-worthy, I have safely crossed a lake in one in a storm when the waves ran three to four feet high.

The most characteristic tree of Guatemala is one whose name or botanical relations I have not learned. It is the tree that densely covers all the higher summits. In the case of pines, cedars and oaks, it is a question whether the forest is primeval, or has grown upon ground once cleared and cultivated, but these summit forests have clearly never been touched by man, and in the deep recesses of these woods among mossy rocks, in dripping mists and shut in from the sun one can feel that he is where no human being has ever been before. These trees have large and lofty bare trunks, in appearance like our white oak, but the tops, from the small, glossy green leaves and the dense spray look like the box, and we call it the "box-tree." Where these forests occur I have never found any ruins, and I am sure man has never occupied that ground. On those table lands and slopes where the forests of this tree have been cut off, they do not appear to grow again, but are replaced by pine, or remain clear and afford pasture for flocks of sheep, from which the Indians derive the wool for their clothing and blankets.

These extensive pastures are close-cropped, and poor because of two creeping herbs that carpet the ground, flat and close-pressed to the surface. One of these is a geranium. These pastures have existed probably for centuries, and are mostly above 9000 feet. Below this altitude, next below these pastures, considerable wheat is grown; also some corn, but this does not thrive well above 8000 feet, but below that elevation it is the principal crop to the sea-level, and is the universal and chief food of all the people.

At 8000 to 9000 feet we are also in the region of the potato. These are small, but have such a nutty and delicious flavor that, cooked in their jackets one can eat them like nuts, without any accompaniment; not even salt seems necessary. They are never planted, but in the dry season a row of men and women begin at the bottom of a slope and hoe the ground down-hill-ward, picking up all the tubers that appear, and enough remain for seed for the next crop, while at the same time the ground is made mellow for their sprouting, all over the ground as if they had been sown. These potatoes are packed in nets or large leaves lined with grass, and carried on the Indian's back to the lower country and the cities for sale.

To make the story complete I must add oats to the list for this region, but they are raised only to a small extent, and not at all by Indians, and only for the horses of the hated white man.

And now we must descend lower and leave this lovely and attractive region of bright sun and balmy breezes on one day, or on one side of a mountain, and of driving mists and chilly winds on the other. The conditions of life seem near perfection, no enervating heat, no insects, no malaria, seldom frost, and no snow, hail, or other inclemency. It is a sanitarium unexcelled, and would be a perfect resort for summer or winter, and may be when the Inter-Continental Railway is built. On these charming *altos* and table-lands the native races have lived for ages, slowly gaining headway on the forests and deriving a subsistence, as do their descendants at the present day, by the cultivation of *corn* chiefly, and also *frijol*, or black beans, potatoes, a sweet pumpkin, and *chile*, or red peppers. As now, they made their picturesque clothes from the cotton of the hot lands, and the wool of the cold. But, though they lived in a Paradise, and perhaps for that fact, they do not seem to

have lived in peace. The many languages surviving to this day in mere fragments of tribes, in isolated patches, and often mixed, would seem to show that many different peoples came here and took possession of the fruit of previous occupants, and were in their turn subdued or driven away from their mountain fields. Thus the cupidity and necessity of races or classes is ever making turmoil and changing the established order. These people seem fixed to their soil, like the very trees. Sometimes a village seems all that remains of a race, surrounded by other languages, unintelligible to it. The languages, traditions, and racial characters of the various tribes of Guatemala Indians are a rich field for the study of anthropologists, and is almost unknown, save what the German, Dr. Behrendt, did in his short life, and whose manuscripts fortunately fell into the hands of our own accomplished anthropologist, Dr. Brinton, of Philadelphia, who is giving the results to the world.

As we descend below 8000 feet the oak becomes an important element in the forests. There are several species of the scrub, black and willow, or chestnut kinds, and none like our white or red oaks, as far as I have seen.

As the pine characterizes the lava, ash and sandstone soils, so the oak does the limestone and schist, as well as ash soils. The oak forests are generally more sparse than others, and seem secondary; that is, have overgrown ground cleared one time by the ancient inhabitants. On lava and ash soils, especially on rocky slopes and in barrancos, the pine and oak are often mingled. Along the ancient Indian roads are rows of oaks, with curiously gnarled and curved trunks, looking very ancient. This oak often divides near the ground into two horizontal arms, and from these several vertical trunks rise up into low trees. There are also other common trees along the ancient paths, an elderberry of tree-like size and form, and a euphorbia, low and gnarled, but with trunks several inches diameter; also cactus trees, wild cherries and box elder. At this altitude, also at 8000 feet in the upper temperate belt, occurs our own well-known sweet gum, the *Liquidambar styraciflua* L. I have met it only on the Pacific side, and on one mountain of the interior, forming green groves about springs and brooks on the mountain side, while all the other trees were brown or dull in the dry season and in the dry belt.

From 7000 to 3000 feet elevation the country is so thickly inhabited, cleared and cultivated that the forests are small and unimportant, except on the Gulf slope of the mountains, where the forests are very dense and little known. I have penetrated through them for three years, yet can hardly say I have seen them. One must hew a path through them with axe and cutlass, and can see only the numberless and thickly matted and intertwined vines, lianes and briars, ferns, bamboo-grass and knife-grass, will brush and bother unending, and the close-standing trunks of the unknown trees; but their flowers or foliage never. After three years I have not yet seen the leaves of the cedar, mahogany, silk-cotton and others whose identity I have otherwise learned.

But the reason partly is that I had duties that prevented my making a special study of such matters. I have gone up mountains where the underbrush was so densely matted that my cutter ahead would open only a tunnel next the ground high enough for us to crawl on hands and knees for distances of several hundred feet at a time. Such circumstances are not favorable for observations of Nature.

At these middle altitudes fruit trees come forward; but there are very few wild fruits—a wild plum, a wild cherry like ours, the large zapate and the manzanilla, are all that occur to me. The plum is yellow, and rather sour and astringent. The wild pigs, or peccaries, of which there are three species, are very fond of them. The monkeys, of which there are two species (the Spider and the Howling), live to a great extent on the zapate, whose tree is large and lofty. The Indians are also very fond of it, and make distant excursions into the woods to hunt for it and for wild honey. Sometimes in the depth of the woods one comes to a large zapate tree, with a rude ladder of poles fastened to the trunk extending up to the top, for gathering its fruit. Some families keep secret certain zapate and bee trees, and visit them each year. Of cultivated fruits at these altitudes there is the Agnacate (called Palta in Peru and Alligator Pear in the West Indies), the apple and the peach. There are few Indian villages and hamlets that are not rosy with peach blossoms in the season. Rose bushes, too, and geraniums in profusion are about their huts and fences. Apples are not so common, and appear to be of late introduction. Coffee comes into cultivation at 6000 feet, but thrives best at 3000 to 4000 feet.

And now comes to our notice the silk-cotton tree, or Ceibo, with its great buttressed trunk and its wide-spreading branches. This tree is very common in all the lower forests down to sea-level. The wood is light, and often used for dug-out canoes, but they last only two years without decaying. There is another tree, with a beautiful straight cylindrical trunk, whose wood is so soft and elastic that an axe almost sinks into it at one blow, and can hardly be pulled out again. There is still another peculiar tree whose wood is so hard that, in spite of efforts, I have never known one to be cut down, the cutters always giving up in despair, and when it has to be removed the Indians build a fire around it, and keep it up until the monarch falls.

Already before we pass below 3000 feet the sugar cane and cotton are planted, but coffee at 6000 and cane at 4000 are on rare occasions killed by frosts, as happened winter before last, produced by the same cold waves that carried destructive frosts to lower Florida and Cuba. Also now occur all the well-known tropical fruits, — mango, orange, lime, pineapple, plantain, custard apple and banana, and they improve downwards to sea-level.

Below 3000 feet, in the *tierra caliente*, we are in a torrid climate. Everywhere, except in the dry belt, vegetation is exuberant, overpowering. It is a hard and expensive struggle to keep ground open enough for cultivation, and neglected ground soon reverts to forest. Even in inhabited parts all the unused spots of ground are so covered that houses and fields are hidden in a general view, and it seems a marvel where all the people live who are known to inhabit the place. But the greater part of Guatemala below 3000 feet is now uninhabited, and covered with rampart forest, primitive or secondary. Two ancient cities are found in this forest, and at many other places are remains, showing that in ancient times a dense population existed where now is forest.

These forests at sea-level have been described by others in terms of admiration and rhapsody, as by Charles Kingsley, and I need not undertake it. I have travelled by canoe up and down various rivers for some 800 miles, on broad expanses with views over desolate marshes, and in profound narrow channels hemmed in by lofty precipices, and under a leafy archway, the branches of trees on the two banks meeting overhead. Sometimes two opposite fallen trees will bar the way, and an opening has to be cut. A

peculiarity is that one cannot boat along the shores, for trees overhang and shoot out at all angles over the water to reach the sun with their tops. There is a palm-tree that has the peculiarity of sending its trunk out horizontally from the bank, only a few feet from the water, for some forty feet, and then turning up vertically and spreading its crown of leaves to the sun.

There are very many species of palm. Most of them are in the hot country, and in rich, moist hollows, or on river bottoms. Many send up their leaves in graceful sweeps from a subterranean stock, others rear their crowns on lofty shafts. The cocoanut palm likes the immediate sea-shore best, the manuca, flourishes along the great rivers. There is a peculiar palm that prefers the dry belt, abounds on rocky hills, and extends up to 5000 feet above sea, or over. This is highly valued, its leaves being used for weaving hats and *petates*, the mats or palm cloth universally used for sleeping rugs and for wrapping baggage and goods for transportation by mules or on the backs of Indians. Palm-leaves are very extensively used in hut-building, especially roofing; also by travelling parties, to make temporary shelters, called *Chiampas*, to pass rainy nights in the woods. But it requires the skill of the Indians to make them waterproof. In a few minutes fifty men can erect these chiampas, and sleep dry all night in a pouring rain.[1]

The mahogany, of which there are two or more species, never forms a forest, but occurs in clumps or singly among other trees, and the same is the case with the rubber tree, of which also there are several species. These trees occur scatteringly through all the forests, aggregating a great total. During a freshet I have seen hundreds of mahogany logs dashing down the rapids of the Mumacinta River, to be caught up and loaded on ships at its mouth on the Gulf. Also many cedar logs came down from the upper affluent, the Ococingo River. The rubber trees are not cut down, but only bled at intervals, until they succumb. The white sap, or rubber milk, hardens in the air to brown-black, quivering cakes, which are carried by men, mules and canoes to the sea-coast for shipment. The rubber-hunters penetrate the woods everywhere, and endure great privations; they have no fixed abiding-place, but move from tree to tree, gathering their crop pound

[1] On swampy sea-shores and up the swampy rivers and on coral key the impenetrable mangrove holds sway.

by pound. On the contrary, the mahogany-cutters, when a place is found with enough trees for a season's cutting, build themselves a village of substantial huts and keep house, bring with them into the forest wives, children, pigs, chickens, dogs, and all their *lares* and *penates*. They may stay one year, or many. But finally, the woods being exhausted of suitable trees, they all depart, the houses decay and fall, the forest regrows and resumes its sway, and all that remains years afterwards are a few stunted banana, orange and mango trees, smothered and hidden by the lusty native forest. There is a large tree very frequent in the dry plains and low hills of the hot lands called the *ramon* tree. Its leaves are glossy green and leathery, of small size, and afford, with the twigs, a most nutritious fodder for cattle and mules. When they have it they will not touch grass. It is sweet and mucilaginous. For months my mules have depended on it. I had nothing else to give them.

Last of all we come to the logwood, which grows only along the margins of sluggish rivers, lagoons and marshes and in swamps at or near sea-level. I know of two species, brazil-wood and campeachy-wood. The latter is the most valuable, I suppose, because the color of its decoction more closely imitates the color of the red wines, in whose manufacture it is so extensively used. As our imported wines bring high prices, logwood has a corresponding value. It sells by the pound. It is a heavy wood; a stick four feet long needs to be only a few inches in diameter to weigh 100 pounds. On account of its peculiar habitat it is hunted by canoe, and when cut has to be carried by canoe to some shipping-point. It cannot float. It sinks to the bottom like a stone. During the last 300 years thousands of tons of it have been shipped from Belize, and by accident so many logs have sunk to the bottom of the harbor and been lost, that now, when it is proposed to dredge the harbor to improve it and fill up certain shallows in the manner of the Potomac Flats, it is believed that the recovery of this logwood will go far towards paying for the work.

The second cause for the diversity of plant life I gave as the meteorological influence of topographical features on climate. As the moisture-laden trade winds from the Caribbean Sea reach the land, and they are deflected upwards more and more as they blow inland, and as the mountains rise higher and higher. This ascension

rarifies the air, cools it and reduces its capacity for holding aqueous vapor, and results in condensation and copious rainfall. It is like squeezing a saturated sponge. When the culminating summits of the Cuilco Mountains, the Sierra Madre, Sierra de Chania and Sierra de las Minas are reached, the last squeeze is given to the sponge and the winds cross over to the interior table lands, dry. This causes a dry belt along the leeside of these mountains extending from Facaná and Cuilco in the northwest by way of Huchuetenango, Chiantla, Rabinal and Salamá to Zacapa and Chiquimula in the southeast. As the air descends from summits of 12,000 to 8000 feet high to the interior plains of only 7000 to 1000 feet elevation, it expands again and takes up moisture from the soil, dessicating the climate further and making the dry belt a very marked feature of the country. One writer even calls the low hot plains of Zacapa a "desert." The pine is very common in this belt at all elevations in favorable situations, and also the oak above 3000 feet. In the driest parts and in rocky places the character of the vegetation is special and peculiar. Cacti, thorny mimosæ, and many kinds of thorny and prickly shrubs abound. As the air rises again, or the higher currents reach the summits of the mountains facing the Pacific, the sponge, replenished from evaporation over the dry belt, is squeezed again, causing mists and copious rain, and limiting the dry belt to the south and southwest.

The Pacific slope has a moist, tropical climate of its own from the influence of the ocean winds, and is independent of moisture brought from the east.

Finally, I have to mention a third great cause affecting the forests of Guatemala; the influence of the ancient people who cleared nearly or quite all the ground that is cultivated or pastured to this day, and much more besides that has become overgrown again with forests. The general proposition will hold that all the clearings of the ancient people in the dry belt, and most of them in its semi-dry borders, have remained cleared, whether cultivated and pastured or not, excepting grass, weeds and shrubbery scattered and in clumps. But to this general rule there is a remarkable exception. In favorable situations, as to moisture and depth of soil, pine forests, with some oak, cover the ancient fields and village sites. In such clean open pine forests, terrace walls, ruined structures, and whole villages are found, but all very ruined and ancient-looking.

A great pine tree may blow over and expose under its roots a stratum full of potsherds and other remains. Not far off open pine woods may border on a dense primitive forest hardly penetrable, the line between the two sharp and distinct, showing where the ancient axeman stayed his hewing. Pine forests also cover the country about the ancient city of Quirigua, on the Caribbean Coast, and I believe cover the fields of the dense population that must have supported a city so great as shown by its numerous and artistic sculptured remains. The city of Zikál is also hidden and covered up in the deep woods, with some of its walled towers yet reaching above the great forest trees, but I do not know whether these are pines. It appears then that many primitive angiospermous forests have been replaced by pine forests through the intervention of the ancients, but in the moist hot regions other angiospermous forests have followed the primitive ones destroyed by man.

In the valleys of the Salegná and Lagartero the heavy rains have denuded the ancient fields of their soil, leaving a stony desert over many square miles, and where forests can never again find a footing. And these curious stony regions now deserted and desolate are strewn everywhere with remains of former populations.

In the Petten, in the northern part of the Republic, are great areas, bare of woods, and grass-covered, called *Sabanas*. These are also ancient fields, now unused and unoccupied except at a few small villages for raising cattle. The limestone hills and ridges remain covered with the primeval forest, and at their bases and also at the borders of the inhabited regions the line of division between *Sabana* and forest is as sharp as when the ancient man made his clearings.

I recognize two causes that in their combined action have prevented the renewal of the forest. These *Sabanas* are in the middle of the lowlands between the Caribbean Coast and the mountains. As the saturated winds reach the forests on the Coast, their cooling influence causes heavy precipitation, the same as a mountain. The coast rains are well-known. But as the winds go over the interior plains without ascending, no further precipitation takes place till they reach mountains; hence the middle plain acquires the character of a partially dry belt, so that for several months in the dry season no rains occur, and the ground is parched and the vegetation partially dries up.

Now it happens that the region cleared by the ancient inhabitants has a tough clayey soil of such a nature that it bakes dry and hard in the dry season; grass and weeds dry up, and young trees that would germinate in the wet season are as regularly killed in the dry. These Sabanas show numerous ancient remains; and these and also the pine forests deserve to be thoroughly examined by archæologists. Much might be learned to shed light on the studies already made on the more modern ruined cities and sculptured temples of Central America.

MOUNTAIN-UPTHRUSTS.

BY CHARLES A. WHITE.[1]

CERTAIN of the mountain ranges of the western portion of our national domain exhibit in a clear and striking manner the evidence that they have originated in uplifted folds of the earth's crust. One of the simplest and most characteristic of these orogenic folds is the one in which the Uinta Range of mountains originated.

Other uplifts of a similar character have occurred, but which, having been of limited longitudinal as well as lateral extent, have resulted in comparatively small clusters of mountains, and not in mountain ranges proper. The Black Hills of Dakota have originated in one of these circumscribed uplifts.

In Northwestern Colorado two uplifts occur which, so far as the character of the displacement and of the formations involved are concerned, are similar to those which have just been referred to; but they have occurred within such narrow limits, respectively, that they have each resulted in only a single mountain. The limits of each of these uplifts are so sharply defined, and the amount of vertical displacement of the strata involved is so great, that I have designated them as upthrusts.

A description of these upthrusts is the special object of this article. But as they are structurally connected with the great Uinta fold and with other neighboring displacements, it will be necessary to devote a considerable part of it to their description also.

[1] Published by permission of the Director of the U. S. Geological Survey. The substance of this article will be embraced in one which is to appear in his Ninth Annual Report.

The great Uinta fold has usually been described as terminating abruptly in Northwestern Colorado. As a conspicuous fold it does so terminate there; but continuous with its axis to the eastward there is a long, gentle anticlinal, which reaches by a broad curve to the foot-hills of the Park Range—a western porton of the Rocky Mountain system. This I regard as a continuation of the Uinta fold far beyond its reputed termination, and also, in connection with other facts, as indicating structural relationship between the Uinta and Park Ranges. I therefore divide the Uinta fold into two portions—namely, the Uinta fold proper, and the inceptive portion of the same.

The Uinta fold proper is about one hundred and fifty miles in length, and from thirty to forty miles in width at the extreme limit of the upturned strata at either side. Its western end is blended with the Wasatch Range in Utah, which it meets at nearly right angles. Its eastern terminus is about thirty miles within, and east of, the western boundary of Colorado, and about the same distance from the northern boundary. Its axis, except the slight southward inclination of its eastern end, is approximately east and west, and at nearly right angles with that of the Park Range.

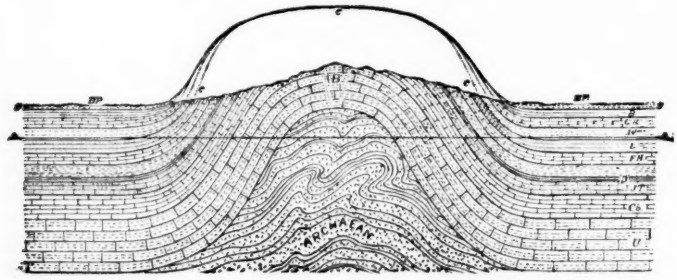


FIG. 1.—A generalized section across the Uinta Fold.

This great fold is remarkable for its simplicity, its almost entire freedom from lateral complications, and for the extent of its vertical displacement. Its type of uplift is also peculiar, the sides being abrupt and the top broadly convex. The accompanying generalized section across the fold (Fig. 1) indicates its general character, and also shows the formations which are involved in it.

The irregular line, SS, represents the land-surface, and the straight line, AA, the sea-level. The dotted line at either side of B represents the depth to which Green River has cut its cañon in traversing the Uinta Range. The dotted lines above the surface-line represent the portions of the formations which have been eroded, and the extent to which they would have been elevated in the fold if they had suffered no erosion.

The dotted line, ccc, is continuous with the top of the Laramie group. This indicates that all the formations below that line were fully involved in the fold; while the other dotted lines which lap upon either side represent the eroded portions of the four fresh-water Tertiary formations, which were successively less and less involved in the fold as the elevation progressed.

The initial U. indicates the Uinta Sandstone; Cb. indicates the Carboniferous; J. T., the Jura-Trias; D., the Dakota Group; Co., the Colorado Group; F. H., the Fox Hills Group; L., the Laramie Group; W., the Wasatch Group; G. R., the Green River Group; B., the Bridger Group, and B. P., the Brown's Park Group.

The following table gives the names and the ascertained thickness of the formations which are more or less involved in the fold, or which occur in its immediate vicinity:—

Cenozoic	Tertiary.	Brown's Park Group	1200– 1800	feet.
		Bridger Group	100– 2000	"
		Green River Group	1400– 2000	"
		Wasatch Group	2000– 2500	"
Mesozoic	Cretaceous.	Laramie Group[1]	2000– 3000	"
		Fox Hills Group	1800	"
		Colorado Group	2000	"
		Dakota Group	500	"
	Jura-Trias		2500– 5000	"
Palæozoic	Carboniferous		3000– 4000	"
	Uinta Sandstone		12000–14000	"
Archæan				

The facts upon which the construction of the foregoing generalized section is based indicates that all the formations, from the Uinta Sandstone to the Laramie Group (inclusive), were fully involved in the great fold, and that the four fresh-water Tertiary formations are only partially involved in it. The latter formations were respectively deposited in large fresh-water lakes, the existence, height and limits

[1] I here provisionally place the whole of the Laramie Group with the Cretaceous formations.

of each of which were determined by the successive changes in the configuration of the land-surface, as elevation and degradation progressed.

Again, although the Archæan rocks are theoretically represented in that section, they have not been brought to view in the axis of the fold, because even the immense erosion which the uplifted strata have suffered has not been sufficient to reach them there.[1] Therefore, in estimating the amount of vertical displacement which has taken place in the Uinta fold, I have reference only to the formations from the Uinta Sandstone to the Laramie Group (inclusive).

Now, referring to the foregoing table, we find that the minimum thickness of these formations aggregates twenty-three thousand eight hundred feet. Add to this five thousand feet for the height above the level of the sea at which the lowermost strata of the Uinta Sandstone have been observed, and we have an aggregate of twenty-eight thousand eight hundred feet. The evidence seems to be conclusive that the elevation of the fold began immediately upon the close of the Laramie period; and it is confidently assumed that none of its strata were then much if any above the level of the open sea. Hence the conclusion that the full amount of vertical displacement in the Uinta fold has not been less than twenty-eight thousand eight hundred feet.

The evidence derived from a study of the great fold seems also to be conclusive that its elevation was continued between the close of the Laramie period and the close of the Tertiary; and other evidence is equally conclusive that continental elevation was continued during the same time. That is, it is assumed that the orogenic movements which have resulted in the production of the Uinta and other mountain-making folds were approximately synchronous in their origin and coeval in their duration with the epirogenic[2] movements by which the great continental area upon which those folds now rest was raised to its present elevation above the sea.[3]

[1] Archæan rocks are exposed within a limited area upon the northern side of the fold; but they were evidently a part of an uplift which was older than the fold.

[2] Etym., *Ἤπειρος*—mainland, or continent.

[3] Certain epirogenic movements must necessarily have taken place to form the barriers by which the Laramie sea was cut off from the open oceans. Local unconformity among the Laramie strata which has been observed near the top of the group in Southern Wyoming indicates that certain other premonitory movements took place before the Uinta fold was well defined.

The inceptive portion of the Uinta fold is, of itself, by no means a conspicuous geological feature—first, because a broad valley or basin, which I have called Axial Basin, is formed along the greater part of its length by the erosion of the strata which have been uplifted there; and second, because the uplift is comparatively slight. A transverse section (Fig. 2) across Axial Basin shows the character of this portion of the fold, and it also shows the formations which are involved in it.

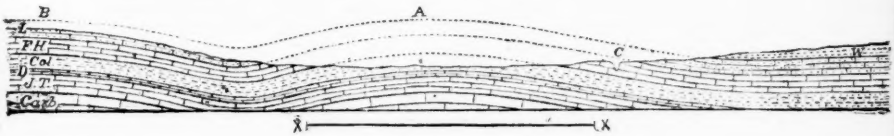


FIG. 2.—Transverse section across Axial Basin.

A. indicates the axis of the inceptive fold; B., the north base of Danforth Hills and a part of that uplift; C., Yampa River. Carb. indicates Carboniferous strata; J. T., Jura-Trias; D., Dakota Group; Col., Colorado Group; F. H., Fox Hills Group; L. Laramie Group; W., Wasatch Group. The line xx indicates proportionally the longer diameter of the Yampa Mountain upthrust, and also its position with reference to the inceptive axis.

Horizontal scale: 4 miles to the inch.

Vertical scale: 1-12 inch to 1,000 feet.

This comparatively slight fold becomes of great importance because of its evident relation to the great Uinta fold, and especially because of the presence upon its axis of the two upthrusts which have been already referred to, the presence of each of which is marked by an isolated mountain which rises abruptly out of Axial Basin. These are, Junction and Yampa Mountains, which are plainly outlying, isolated members of the Uinta Range.

The main portion of the Uinta fold terminates at its eastern end by a dip of the uplifted strata which is quite as abrupt as that at either side of it, and which carries them far beneath the surface of the adjacent lowland. Going now, only two or three miles eastward from this eastern terminus—where we have seen the later formations dip so suddenly from view—we come to the western border of Junction Mountain upthrust. Here we find the same strata to rise again, even more suddenly than they disappeared; and

we also find that the formations of Palæozoic age—which constitute the high mountain-peaks of the Uinta Range only a few miles away—are here again uplifted, not only to the surface of the low land around the mountain, but to a maximum height of nearly two thousand feet above it. The strata involved in this uplift—which, because of its sharply-defined limits and of the vertical displacement of these strata, I have called an upthrust—occupy an elongate oval area, the extreme longer diameter of which is nearly twelve miles, and the shorter about four miles. The direction of the longer diameter, being in a northwestward and southeastward direction, is obliquely transverse to the general trend of the axis of the Uinta fold. In this respect, as well as by the peculiar character of displacement of the strata involved, the isolation of this upthrust is quite complete, although it lies so near the terminus of the main portion of the Uinta fold and upon the axis of its inceptive portion.

So sharply have the strata been uplifted in this displacement that they are either faulted or are nearly or quite vertical at a portion of each side of the upthrust, and they also dip very abruptly at other portions and around its ends. The Mesozoic formations, through which the older ones were forced, lie all around the mountain, but immediately adjacent to it they are largely covered from view by the strata of the Brown's Park Group, which lie unconformably upon them. The disturbance which these Mesozoic formations have suffered in that neighborhood beyond the base of the mountain is so slight that one cannot recognize it as having been connected with the upthrust movement. That is, their position as marking the presence of the inceptive portion of the Uinta fold and of certain subordinate uplifts does not seem to have been changed by the localized upthrust movement.

The Mesozoic formations,—which must have necessarily risen on the top of the older ones within the upthrust area,—have been removed by erosion, as has also a large part of the full thickness of the Carboniferous strata which came up beneath them. Therefore, only strata of Palæozoic age now enter into the structure of the mountain proper; while the upturned edges of the later ones, where they have not been sharply severed by faulting, lie around its base.

Going from Junction Mountain about sixteen miles along the axis of the inceptive fold, we pass all the way over the low lands of Axial Basin, the surface of which is there mostly occupied by the

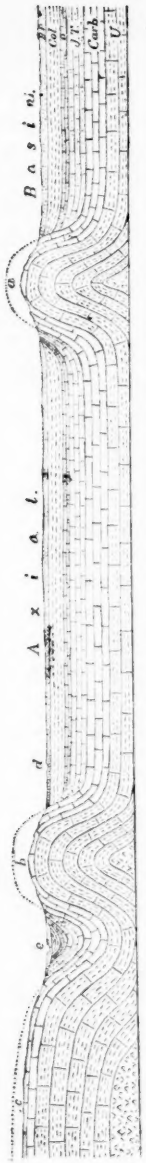


FIG. 3.—Section showing the eastern end of the Uinta fold, and the Junction, and Yampa Mountain Upthrusts.

Brown's Park Group, and reach Yampa Mountain, which rises directly upon that axis, as does Junction Mountain. Here we find that the description that has just been given of the Junction Mountain upthrust will apply in all essential respects to this. All around the base of Yampa Mountain the strata of the Brown's Park Group cover the immediate borders of this upthrust, even to a greater extent than they do those of Junction Mountain upthrust; but it is readily seen that the two mountains are essentially identical in structure and character, and that they have been produce in a similar manner. Yampa upthrust, however, is smaller than the other, and it is also much farther away from any other greatly displaced strata. Its outline is oval, the longer diameter, including all the strata involved,—not much exceeding seven miles in length,—and its shorter diameter is less than four miles. The longer diameter is nearly at right angles with that of Junction Mountain upthrust, and it is nearly transverse with the inceptive portion of the Uinta axis, upon which it rises. The relation of these two upthrusts to each other and to the main and inceptive portions of the Uinta fold is indicated by the section, Fig. 3.

a, Yampa Mountain; b, Junction Mountain; c, eastern end of the Uinta Range; d, Yampa River, before entering Junction Mountain; e, Snake River; U., Uinta Sandstone; Carb., Carboniferous strata; J. T., Jura-Trias; D., Dakota Group; Col., Colorado Group; B. P., Brown's Park Group.

Horizontal scale: 5 miles to the inch.

Vertical scale: 1-20 inch to 1,000 feet.

The amount of vertical displacement is about the same in each of these upthrusts, the extent of which is estimated from the thickness of the formations (as given in the foregoing table) and from the contour lines on the published topographic maps of that

region. The contour line which cuts the top of the Uinta Sandstone in both these mountains passes along the southern side of Axial Basin, approximately at the base of the Laramie and the top of the Fox Hills Group. Referring to the preceding table, we find the thickness of the intervening formations to be eleven thousand eight hundred feet. It is therefore plain that the amount of vertical displacement in both these mountains is not less than is represented by those figures. That is, within the narrow and sharply defined limits that have been described, the strata of which both these mountains are composed have been thrust up a vertical distance of more than two miles,—which in the case of the Yampa upthrust is nearly equal to one-third of the longer diameter of the area affected by it.

As indicating that the amount of vertical displacement in these upthrusts is really greater than has been mentioned, it may be stated that the Fox Hills and Laramie strata referred to have themselves been elevated to a considerable extent in the adjacent Danforth Hills uplift (as shown by the section, Fig. 2). This figure will also serve to illustrate the relation of the Yampa upthrust to the inceptive fold and to the adjacent Danforth Hills uplift. That is, if within the space indicated by the length of the line xx the strata should be elevated until the base of the Carboniferous series reaches the place of the uppermost dotted line, the vertical extent and lateral restriction of the Yampa upthrust will be indicated.

It is true that the vertical displacement in the case of these two upthrusts is much less in amount than is that of the great fold; but the amount of displacement is far more remarkable in the case of the upthrusts than it is in the case of the fold, because of the very narrow limits within which the displacements in the former case have taken place. The narrow and sharply defined limits of these upthrusts, and the severing of the displaced portions of the formations from the great mass of each respectively, with little or no general disturbance of the latter beyond those limits, may be compared to the action of a large punch on being forced by great power through a number of thick iron plates. The comparison will be more complete if we conceive that the cutting-border of such a punch had become dulled at certain places, so that a part of the iron through which it was being forced would drag and not be sharply severed. Portions of the uplifted strata at the base of both these mountains

seem to have thus dragged during their elevation; while other portions were sharply severed, as if the displacement had really been done by a huge punch acting from beneath, producing an ordinary fault there.

The evidence that the orogenic and epirogenic movements which have resulted in the present physical conditions in the Western portion of our national domain were coëval with each other, seems to be unmistakable, so far, at least, as the time-limit of each series of movements is concerned. But, considering for the present only the orogenic movements, it is evident that the uplifting force has been applied along certain lines with great inequality, both as regards the amount of force locally exerted and the duration of its application. That is, in the region especially referred to in this article there are indications that while the orogenic displacements now observable there were in progress there were local arrests and accelerations of the elevating movement, which produced a final diversity among them that did not exist in their inception.[1]

For example, the present structural condition of the Uinta fold seems to warrant the assumption that it was once, along its entire length, in the condition in which its inceptive portion now is, except for the presence of the upthrusts. Furthermore, that these upthrusts, as well as the main portion of the fold, continued their upward progress, while the present inceptive portion remained as it was when its elevation was arrested. There are other plain indications of the arrest and acceleration of uplifting force in that region; but the upthrusts rising upon the inceptive fold constitute the most striking examples.

The elevating force was not only strangely concentrated in the case of the two upthrusts, but it seems to have been applied in an unusual manner, especially when we consider the position of the longer axis of each with relation to that of the other, and also to that of the Uinta fold. It has been mentioned that the longer axis of the Junction upthrust lies in a northwest and southeast direction, and that of the Yampa upthrust in a northeast and southwest direction. Viewing these upthrusts only in relation to the Uinta fold proper, and regarding them as nearly or quite isolated portions of the same, one would naturally expect to find their longer axes coinciding with a line projected from the axis of the main fold, and he would also expect to find the intervening strata along that line to

have partaken largely in the upward movement. That is, in view of the simplicity of the main portion of the Uinta fold, one might naturally expect that the uplifting force which was applied along its entire axis would have acted strongly and continuously, if not uniformly. But the foregoing statements show that neither of the upthrust axes coincide with such a line or with each other, and also that only a comparatively slight elevation of the strata has occurred along what I have designated as the inceptive portion of the Uinta fold.

These upthrusts are so extraordinary in their character that one instinctively desires to know how they were produced. I freely admit my inability to reply to such an inquiry in a satisfactory manner; and for the present I will offer only the following suggestion. Assuming—as the evidence seems to warrant us in doing—that the completion of the main Uinta fold and that of the Park Range were contemporaneous, or nearly so, they constituted ponderous buttresses at either end of the strongly-curved inceptive portion of the Uinta fold. It is not strange, therefore, that any elevating force that may have been applied along the axis of that inceptive fold—which stretched across the intervening space—should have been diversely, if not abnormally, applied.

NOTES ON THE GEOLOGY OF JOHNSON COUNTY, IOWA.

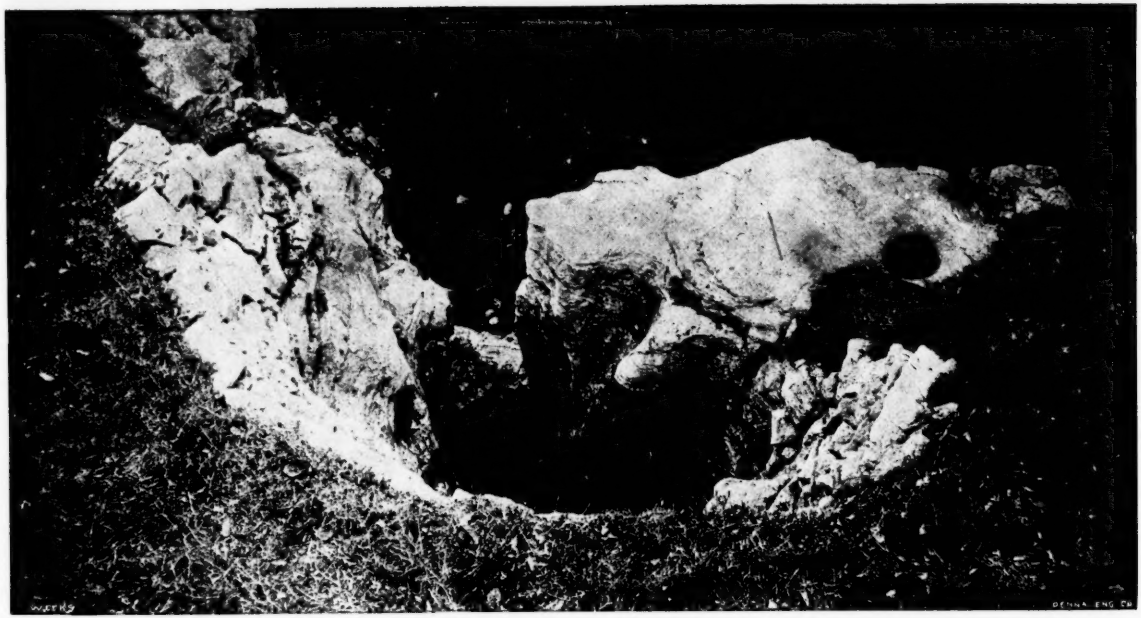
BY CLEMENT L. WEBSTER.[1]

THE superficial geology, or the study of the nature, origin, and distribution of the loose materials, or superficial detritus commonly denominated loess, drift, and aluvium, constitutes one of the most interesting as well as important fields for study that fall within the scope of investigation of the geologist.

The interpretation of the phenomena of the glacial period, the cause of the advance and retreat of the ice sheets, the condition of the climate and of the fauna and flora of the surface (now covered by drift) during the interglacial time, the extent and condition of

[1]State University, Iowa.

PLATE V.



POT HOLE, NO. 2.

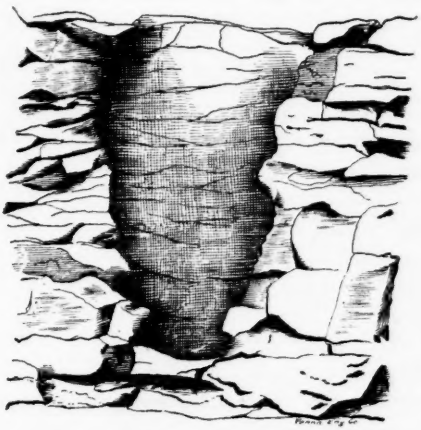
the preglacial river channels which have become obliterated, at least in part, and the condition of things during the Champlain period, are all subjects of the most profound interest to the geologist.

In this paper I have endeavored to elucidate some of these phenomena as observed in Iowa, and it is hoped that it may not be without at least some value to the broad field of science.

In the hard Devonian limestone in the west bank of the Iowa River, at Iowa City, are numerous (often large) very interesting potholes, which have been formed by the action of running water; and as they shed so much light upon the condition of things at this locality at the beginning of the Carboniferous age, a short description of a few of the more prominent ones here is deemed not to be without interest and value.

The rocks in which these potholes are formed, rises to a height of from twenty to forty feet above the water in the Iowa River.

Pothole number one: Circular, sides smooth and symmetrical, sloping gradually to the bottom, upper margin rounded, depth five feet, diameter at the top two feet, and at the bottom one foot.



Pothole No. 1.

The following diagram will illustrate this description:—

One foot from this is another smaller subcircular pothole, having a depth of two feet and a diameter at the top of one foot, and at the

bottom of ten inches, with unsymmetrical but smooth sides; upper margin smooth and somewhat flaring.

About half way from the top to the bottom, cavities have been formed in the sides by the action of the water which formed the pothole. The upper margin of this pothole has a small channel cut through to the east, apparently by the overflow.

Pothole number two: This is one of the largest and most interesting examples to be found here. This pothole has been formed by the union of several minor ones. Its longest diameter is from east to west, somewhat subovate in marginal outline, sides unsymmetrical but smooth, more or less gently sloping to the bottom, upper margins unevenly rounded, depth seven feet, length from east to west seven feet, and width of the eastern portion at the top two and one-half feet, and marginal width of the western portion four and one-half feet, contracting at the bottom to a width of two and one-half feet.

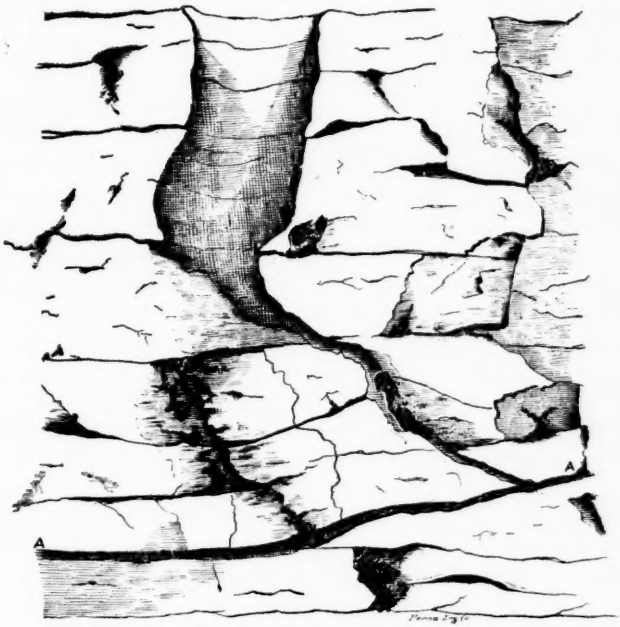
In the west side of this pothole, about midway from top to bottom, large, more or less ramifying cavities, varying from three feet to eight feet in extent, have been worn by the action of the water which formed the pothole. The overflow to the east has cut a channel about three feet in depth and two feeet in width. About four feet to the right of the foregoing is a small bowl-shaped depression, with smooth symmetrical sides, and rounded or flaring margin. Near this is another smaller saucer-shaped depression, having a diameter of sixteen inches, and a depth of six inches. These are beautiful examples of how some of these potholes were begun.

The following cut (from a photograph) will illustrate the form and position of these depressions in relation to the large pothole above described:—

Pothole number three: Subcircular in outline, sides somewhat irregular, smooth, upper margin slightly flaring. For the first four feet the sides are nearly perpendicular; below this point the hole rapidly enlarges to the east, but soon contracts, and continues its downward course in the form of a gradually-narrowing oblique fissure, that finally unites with a rather large, more or less horizontal, crevice between the beds of rock.[1]

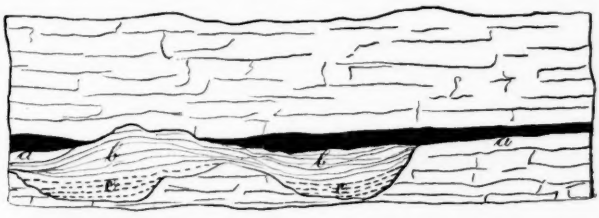
[1] This fissure is filled with a black, combustible, carbonaceous mud of bituminous matter, which is usually underlayed and sometimes overlayed by a reddish-brown clay.

The following diagram will illustrate this description :—
Pothole number four: This is the largest and deepest of any yet



Pothole No. 3. *a a*, coal seam.

observed, having a depth of slightly upward of fourteen feet. Although much of the rock in which this pothole was formed has



a a, coal seam; the lower part shaly and containing fish teeth; *b b*, ash-colored and greenish underclay; *c c*, coarse sandstone in curved laminæ.

been removed by quarrying, yet enough of the excavation itself remains to demonstrate the fact that it was formed by the enlarge-

ment of a deep vertical fissure. In this same rock are numerous other minor potholes of much interest, many of them showing unmistakable evidence of having originated in a larger or smaller vertical fissure, their upper margins being invariably rounded, or more or less strongly flaring, with often a larger or smaller channel cut through to the east by the overflow, thus demonstrating the fact that the flow of water which formed them was from the west. Many of these potholes are filled (and all showing evidence of having been originally) with a hard, stiff, reddish-brown, sometimes brownish-black, clay, similar to the underclay of coal seams. Not only are these potholes filled by this clay, but also the numerous vertical and horizontal fissures and spaces between the rock bedding filled with the same material. This reddish-brown color, however, is probably due to the infiltration from the, in places, very ferruginous drift material, which immediately overlies them.

About thirty years ago, during the geological survey of Iowa by James Hall, important facts (since mostly obliterated by the extensive quarrying of the rock) were observed in regard to this phenomena; and for the sake of greater clearness in the matter, I here give a partial compilation of the description of it as found in the survey:—[1]

"In a cliff of limestone of the Hamilton Group, at Iowa City, the following phenomena is observed:—

"Beneath beds of nearly horizontal limestone appears a black band extending thirty or forty feet: this consists of black carbonaceous mud, the upper part having the character of cannel coal, and the lower part a slaty carbonaceous shale.

"Beneath this, and less extended, a thicker layer of greenish-grey clay, of the character of underclay of coal seams, fills the upper and broader part of the cavity; while below this, and occupying the deepest parts, is a coarse sandstone, which follows, in its line of lamination, the curvature of the limestone upon which it lies."

This description is illustrated by the following diagram:—

"Here we have all the phenomena attending a true coal-measure seam of coal: the sandstone, the underclay, and the coal seam resting upon it; and to complete the analogy, the slaty portion of the seam contains *fish teeth* of carboniferous character. All this is

[1] Hall's Geological Survey of Iowa, Vol. I., Part 1, pp. 129–133 and 265.

enclosed in limestone, which, in the State of New York, where the series is more complete, lies at a depth of more than five thousand feet below the coal measures."

The result of the most critical examination and study of the phenomena as observed to-day, is such as to corroborate the statement then made in regard to this subject, which is as follows:—

"The coarse and fine sand were first transported, and, entering some fissure [probably a pothole] in the rock, continued in deposition in this cavity, while a bed of similar sandstone was being formed outside upon the bottom of the sea. This ceased, and then came the clay, which continued in like manner, while the under clay of an exterior coal bed was in process of deposition.

"Lastly, the carboniferous mud, derived from the material of a coal seam, was filtered through the fissure, filling the remaining space, and spread out in the narrow seam beyond. There is no mingling of the material, as if resulting from the breaking up of a coal seam at a later and modern period.

"Every part is as distinct as in the coal measures elsewhere; and this only could have resulted from a participation in the cause then operating to produce those extensive beds of sand, shale, clay, and coal which make up the coal measures. This point is near the northeast margin of the coal basin, and beyond the limits of any productive coal seams; a few isolated patches of sandstone and shale being all the remaining evidence of the extension of the series in that vicinity."

It is believed that the immediate valley or channel of the Iowa River, from Coalville to Iowa City, and perhaps north from this point, in Johnson County, represents the channel of an old Devonian stream.

Occupying a position in the east side of the valley of the Iowa River, where an abrupt curve is made, near Iowa City, is a patch of soft, friable carboniferous sandstone, having a length of one-fourth of a mile, and a breadth of one-eighth of a mile or less. This sandstone occupies a valley of erosion in the Devonian limestone, and which has a depth of between thirty and forty feet. That this was a valley of erosion, formed by the action of flowing water prior to the time when the sandstone was deposited, is obvious, as the sides of this valley are seen, after the removal of the sandstone, to be smoothed and worn by the long-continued action of running water.

The channel of the Iowa River, from Iowa City north, in this county, has been eroded to a depth of from twenty feet to upwards of one hundred feet into the hard Devonian limestone. As I have before intimated, it is believed that this valley was formed, to a great extent at least, by an old Devonian stream, and then subsequently filled by the sandstone during the Carboniferous age.

The glacial drift in Johnson County, so far as it has been observed, is everywhere covered by a profound mantle of loess, so that it can be observed only along the borders of streams, and along the axis of surface drainage, where the overlying formation has been cut through, thus exposing the drift at the bottom. This formation, so far as can be made out, attains a thickness of from four feet to eighteen feet, and is composed of clay, sand, gravel, and boulders. The boulders, however, are rarely observed, except at the bottom of ravines, where they are sometimes quite numerous, and vary in weight from ten pounds to upwards of two thousand pounds. The drift, for the most part, shows but slight evidence of modification or rearrangement of its materials. In some places, however, it contains an abundance of ferruginous matter, so much indeed as to give it, at limited localities, a deep-red color. The gravel of this formation is made up of more or less rounded fragments of Devonian limestone, derived from the subjacent strata, smoothed and well rounded, often beautiful striated, pebbles of granite, quartz, trap, greenstone, and others of igneous origin, which have been derived from the north. The boulders are also of the same material and origin with the exception of those of Sioux quartzite, which were derived from the northwestern portion of the State. Devonian fossils (and rarely Carboniferous), derived from the underlying rock, are also common. The old forest bed is also well represented, and occupies, as is usual throughout other portions of the State, a low horizon in the drift formation.

While digging a well on the farm of Mr. Joseph Hedger, about five miles southeast from Iowa City, the forest bed was struck at a depth of about twenty-eight feet. This formation was represented by a dark-brown, slightly-combustible peat formation, which was overlayed by, and slightly mixed with, a layer of coniferous wood and twigs. This peat also contained abundant remains of plants, well-preserved seeds (apparently those of grass), and abundant remains of Coleopterous insects. This bed rests directly upon hard,

stiff, distinctly stratified blue clay. This formation has been struck at numerous localities at a depth of from twenty-eight feet to sixty feet below the surface, in the central portion of this county. A usual feature of the peat division of the forest bed of this region are the remains of Coleopterous insects. The peat at all these localities was evidently formed where it is now found, and are parts of one and the same bed.

A limited deposit of similar ancient peat was also discovered in Adair County, one hundred and seventy miles to the westward of Iowa City, on section twenty-two, township seventy-five, range thirty-two. This bed was found to be between two and three feet in thickness. The drift, apparently only slightly if at all modified, rested directly upon it, and it was underlayed by a dull, bluish-clayey bed.

At another locality, near Davenport, fifty miles east of Iowa City, a deposit of peat occurs almost upon the very brow of the bluffs that border the valley of the Mississippi. This example is one of unusual interest, in consequence of the existence there of an extensive bed of ancient peat which is covered to the depth of several feet beneath the prairie soil, and the discovery in the clay, above the peat, of the remains of a mammoth.

The following section, compiled from White's *Geological Survey of Iowa*, vol I., part i., pp. 119, 120, will show the position of the deposit in relation to the drift:—

"No. 1. The ordinary prairie soil, one foot. The prairie here extends to the edge of the bluff, gently sloping backward toward the north.

"No. 2. The 'yellow clay' or loam, twenty feet thick, iron-stained, frequently distinctly laminated; laminæ curved, and have their layers of sand interstratified in some places. It contains small calcareous nodules and shells of the genera *Succinea*, *Helicina* and *Pupa*.

"No. 3. Bluish-grey clay, three to five feet thick, not stratified; contains a few shells like those of No. 2. A tusk, several teeth, and some other portions of *Elephas primigenius* (?) were found, just at the junction of Nos. 2 and 3.

"No. 4. A bed of brown peat one foot thick, which burns tolerably well. In some places the peat moss, *Hypum aduncum*, was so well preserved as to be recognized. Quantities of much-decomposed coniferous wood are distributed throughout this bed.

"No. 5. Ancient soil, two feet thick, very dark loam, resembling the peat, but more decomposed. Contains no shells or other fossil remains.

"No. 6. Blue clay, very tenacious, containing sand, gravel, and small boulders; pebbles and boulders, all water-worn, and many of them distinctly glacier scratched. Thickness unknown."

"The exposure was made by the excavation of the Chicago, Rock Island and Pacific Railroad Company, previous to which there was no appearance at the surface to indicate the presence of anything more than the ordinary drift deposit."

Bed No. 5 of this series is undoubtedly only a more thoroughly decomposed and finely comminuted portion of bed No. 4. This bed of peat, also, like that at Iowa City, contains remains of Coleopterous insects.

While boring a well on the northeast quarter of section ten, township eighteen, range five, in Linn County, a deposit of peat and coniferous wood four feet in thickness was struck at a depth of ninety-nine feet below the surface. From this well, into which a tight galvanized iron tubing has been forced, escapes a constant supply of natural, combustible gas (the peat probably being the origin of it), but whether of sufficient quantity to be of practical value, is a question to be answered by investigation. A few miles from this locality another well of the same character is reported.

In the northern portion of the State the peat formation is seldom, f ever, observed as a member of the forest bed. These beds of peat are of interglacial origin, and was coexistent with the luxuriant forests of conifers which, in interglacial times, covered the surface of what is now known as Iowa.[1] The occurrence also of the well-preserved seeds of plants and the abundant remains of insects in this formation are features of peculiar interest.

A critical and somewhat extended study of the forest bed and other superficial formations in different portions of the State, reveals facts which seem to substantiate the theory advanced in regard to the relative age of the peat formations.

The topography of the surface of Johnson County is, for the most part, peculiarly that of loess regions, being more or less broken and rolling, the elevations having rounded tops, and more or

[1]These beds of peat were believed by Dr. White not to be of interglacial origin. White's Geological Survey of Iowa, vol. i., p. 121.

less rapidly ascending sides, and rising to a height of from ten feet to upward of sixty feet above the intervening depressions.

The valleys of the Iowa River and its tributaries are relatively narrow and deep, and bordered by more or less steep acclivities, and flanked at frequent intervals by deep but narrow and rapidly ascending ravines, and these again often ramify in shallow depressions which draw the water quite effectually from nearly all portions of the upland.

The immediate valley of the Iowa River, as I have before intimated, attains an average width of one-half of a mile, and a depth below its immediate borders of from sixty feet to upward of one hundred and seventy-five feet. Well-defined terraces are sometimes observed along this stream, and they have been produced by the deepening of the valley by the action of the waters of the stream.

As has been before stated, the surface of nearly, if not quite all of this county, is occupied by a loess formation, which effectually conceals the underlying drift formation, except along the valley-sides and the axis of surface drainage, where the overlying deposit has been cut through. This deposit attains a greater thickness along the streams than adjacent to them, and consists, for the most part, of an exceedingly finely comminuted yellow or buff-colored clayey earth, with an admixture of humus in favorable situations, as in the beds of drainage depressions and in the valleys, as well as most usually the more level surface of the upland, which gives to it a color varying from a light-ash to a deep-black. Upon the higher points, however, the soil usually contains comparatively little humus, for the reason that it is swept down by the rains as fast as it is accumulated by the decay of vegetation, and deposited in the beds of ravines and the slight valley bottoms.

The following section, taken at the "brick-yard," in the north-east portion of Iowa City, gave the following result:—

1. Very fine brownish "loamy" soil, containing humus—three inches.

2. Very fine and homogeneous yellow-clayey earth—fifteen feet.

3. Very fine and homogeneous bluish-grey, clayey earth, having more or less numerous brownish-drab streaks running through it, and containing numerous fossils, many of which were in a crushed condition—five feet. Entire thickness unknown.

The different divisions of this section pass into each other by

very gradual and imperceptible gradations. In a railroad cut, about one and one-fourth miles west of Iowa City, the loess is seen to attain a thickness of twenty-three feet and five inches.

The humus-stained division, No. 1, attains a thickness of five inches; while the second, or yellow division, attains a thickness of about twelve feet; and below this, the third, or blue division, which attains a thickness of eleven feet, and rests immediately upon the drift. This portion contains an abundance of fossils, most of which, however, are in a better preserved condition than those of its equivalent at the "brick-yard."

One mile south of Iowa City the loess is seen to attain a thickness of twenty feet, and is very fine and homogeneous throughout, being of a yellow or yellowish-buff color, with the exception of a humus-stained layer, of a few inches in thickness at the top. The yellow clay at this locality rests directly upon the drift, the blue division being absent, as also fossil remains, so far as observed. At Oxford, in the extreme western portion of the county, the typical yellow loess is seen to have a thickness of from fifteen feet to twenty-two feet, the blue division, however, not being present.

No fossils were observed in the loess in this region. Occupying the same relative position to the loess, and presenting the same general character as at other described localities, is the drift formation. At this locality, as well as several others in the county, the loess is seen to contain more or less extensive accumulations of fine silicious sand; also, at two or three places, I observed small accumulations, or pockets, of well-rounded and smoothed quartz and greenstone pebbles of drift origin. This material may have been derived from detritus ladened ice, floating from the north and dropping its burden while this formation was in process of deposition. At numerous localities the loess contains abundant calcareous concretions and ferruginous tubules of various dimensions, while at other localities it is devoid of them.

At Solon, in the northeast part of the county, the loess is somewhat thinner than at the previously-described localities, but is essentially the same, although the lower, blue, division is not noticed, and the upper, black, humus-stained layer, is somewhat thicker, owing to the somewhat less broken surface, and the lessened facility with which the surface is "washed" by rains, thus removing much of the humus accumulated by decomposing vegetation.

Below I give a catalogue of all the fossils yet obtained from the loess of Johnson County; doubtless, however, many others existed which have not as yet been discovered.[1] Those marked * do not occur as living forms in the county at the present time:—

Zonites viridulus (Mke.).
Zonites limatulus * (Ward).
Zonites fulvus (Drap.).
Patula strigosa * (Gld.).
Patula striatella (Say).
Ferussacia subcylindrica (L.).
Pupa muscorum * (L.).
Pupa blandi * (Mone.).
Vertigo simplex * (Gld.).
Mesodon multilineata (Say).
Vallonia pulchella (Müll.).
Succinea avara (Say).
Succinea avara var vermeta,—
Succinea obliqua (Say).
Helicina occulta (Say).
Limnæa desidiosa (Say).
Physa—sp. (?)
Pisidium—sp. (?)

Egg-shell of some small *Helix*.

The loess formation constitutes a prominent feature of the superficial geology of Iowa, being developed to a greater or less extent over a large portion of the State. It is believed that the material of this formation was deposited during the Champlain period; and facts seem to demonstrate, moreover, that this was not only a period of somewhat lower level in Iowa as well as other places, than the present, but also that the amount of depression increased somewhat to the northward, so that the streams flowing to the southward had usually a diminished slope, with a consequently slackened flow of the waters, and many greater or less expansions along their course, and from these silt-ladened waters the material of the loess formation was derived.

[1] For this catalogue of species I am much indebted to Professor B. Shimick, of Iowa City. All the species listed have been personally collected by him.

HISTORY OF GARDEN VEGETABLES.

BY LOUIS STURTEVANT, M.D.

(Continued from page 985, Vol. XXI.)

Fennel. *Fœniculum vulgare* Gærtn.

FENNEL was used by the ancient Romans, as well for its aromatic fruits as for its edible succulent shoots. It was also employed in Northern Europe at a remote period, as it is constantly mentioned in the Anglo-Saxon medical receipts which date as early at least as the eleventh century. The diffusion of the plant in Central Europe was stimulated by Charlemagne, who enjoined its cultivation on the imperial farms. Fennel shoots, fennel water, and fennel seed, are all mentioned in an ancient record of Spanish agriculture of 961 A.D.[1] There are three different forms recognized, all believed to belong to a common species, *Fœniculum vulgare* Gærtn., but which have received specific names by various botanists.

Bitter Fennel. *F. vulgare* Gærtn.

In 1863, Burr describes[2] a common and a dark-leaved form; in 1586, Lyte's[3] Dodœns describes in like manner two varieties. This is the common wild sort, hardy, and often spontaneous as an escape from gardens. It is the *Anethum fœniculum* L., 1763, and the *Fœniculum* of Camerarius,[4] 1586. Sometimes, but rarely, the leaves are used for seasoning, and the plant is chiefly grown for its seeds which are largely used in the flavoring of liqueurs.

The *common* or *bitter fennel* is called in France ***Fenouil amer.***, ***Fenouil commun.*** It appears to be the ***common fennel*** or ***finckle*** of Ray, 1886, the *fœnell* and *fyncle* of Turner, 1538.

Sweet Fennel. *F. officinale* All.

This form is cultivated more frequently as a garden plant than the preceding, and its seeds are also an object of commerce. As the plants grow old, the fruits of each succeeding season gradually

[1] Pharmacographia, 1879, 308.
[2] Burr. Field and Gard. Veg. of Am., 1863, 420.
[3] Lyte's Dodœns, 1586, 305.
[4] Camerarius Epit., 1586, 534.

change in shape and diminish in size, till at the end of four or five years they are hardly to be distinguished from those of the bitter fennel. This curious fact was noted by Tabernæmontanus in 1588, and was systematically proven by Guibort, 1869.[1] This kind has, however, remained distinct from an early date. It is described by Albertus Magnus[2] in the thirteenth century, and by Charlemagne in the ninth. It is mentioned as a plant of the garden in nearly all the earlier botanies. It is cultivated throughout Europe, in Asia and in America as an aromatic garden herb.

The famous "carosella," so extensively used in Naples, and scarcely known in any other place, is referred by authors to *F. piperitum* D C., a species very near to *F. officinale*. The plant is used while in the act of running to bloom; the stems, fresh and tender, and broken and served up raw, still enclosed in the expanded leaf stalks.[3] It is, perhaps, referred to by Amatus Lusitanus[4] in 1554, when, in speaking of the *finocchio* (It.) he says the swollen stalk is collected and said to be eaten, "quod caule turgescente colligitur et esui dicatur."

The *common* or *sweet fennel* or *Roman fennel* is called in France *fenouil doux, fenouil de Florence, fenouil de Malta, anis de France, anis de Paris;* in Italy, *carosella.*[5] These names also seem to apply in part to the next kind. In Turkestan, *shabit.*[6]

Finocchio. *F. dulce* D C.

This form is very distinct in its broad leaf-stalks, which, overlapping each other at the base of the stem, form a bulbous enlargement, firm, white and sweet inside. It seems to be the *Finochi* or *Italian Fennel,* stated by Switzer,[7] in 1729, to have but recently been introduced to English culture, and yet rare in 1765;[8] but the first distinct mention I find is by Mawe,[9] in 1778, under the name of *Azorian Dwarf* or *Finocchio.* It is again described in a very

[1] Pharmacographia, l. c.
[2] Albertus Magnus. De Veg., Jessen ed., 1867, 517.
[3] Vilmorin. The Veg. Gard., 1885, 246.
[4] Amatus Lusitanus in Diosc., 1554, 338.
[5] Vilmorin. Les Pl. Pot., 209.
[6] Gard. Chron., July 25, 1885, 109.
[7] Switzer. Meth. for Raising, etc., 1729, vii.
[8] Stevenson. Gard. Kal., 1765, 46.
[9] Mawe. Gard., 1778.

perfect form by Bryant, in 1783,[1] under the name of *Sweet Azorian Fennel.* According to Miller's Dictionary, 1807, it is the *F. azoricum* of Miller, 1737. Ray,[2] in 1686, uses the name *Fœniculum dulce azoricum,* but his description is hardly sufficient. It is described for American gardens in 1806.[3] It does not seem to have entered general culture except in Italy.

The type of this fennel seems to be figured by J. Bauhin in 1651, and Chabræus, in 1677, under the name *Fœniculum rotundum flore albo.*

The Finocchio or Azorean Fennel is called in France *fenouil de Florence, fenouil sucre, fenouil de Bologna, fenouil d'Italie;* in Germany, *grosser susser florentiner Fenchel, grosser bologneser Fenchel, florentiner Anis;* in Holland, *groote zœte Bologneser grosser venkel;* inDenmark, *dvergfennikel;* in Italy, *finocchio dulce.*[4]

The general name for the Fennels is in France *fenouil;* in Germany, *fenchel;* in Flanders and Holland, *venkel;* in Denmark, *fennikel;* in Italy, *finocchio;* in Spain, *hinojo;*[4] in Arabic, *raisniji;*[5] in Egyptian, *savin* or *tshamar hoout;* in Greece, *marathron;* in Hindustani, *owa;*[6] in India, *souf* or *so, ooa;*[7] in Japan, *sen rio, kure no vomo;*[8] in Yemen, *sekamar.*[6]

Fennel-flower. *Nigella sativa* L.

The seeds, on account of their aromatic nature, are employed as a spice in cooking, particularly in Italy and Southern France.[9] It is supposed to be the *gith* of Columella and Pliny, in the first century; of Palladius, in the third, and of Charlemagne, in the ninth.[10] The *melanthion* of Columella, in the first century, seems a descriptive name for his *gil.* It finds mention as cultivated in most of the botanies of the sixteenth and seventeenth centuries; is recorded by Vilmorin[11] among plants of the garden, as also by

[1] Bryant. Fl. Diet., 1783, 53.
[2] Ray. Hist., 1686, 458.
[3] McMahon. Am. Gard. Cal., 1806, 199.
[4] Vilmorin. Les Pl. Pot., 209.
[5] Camerarius. Epit., 1586, 534.
[6] Pickering. Ch. Hist., 261.
[7] Speede. Ind. Handb. of Gard., 181.
[8] Thunberg. Jap., 120.
[9] Noisette. Man., 1860, ii., 447.
[10] Fee. Notes to Grandsagne's Pliny, xiii., 244.
[11] Vilmorin. Les Pl. Pot., 1883, 374.

Burr[1] in 1863, and is now found in the lists of some of our seedsmen.[2]

The Fennel-flower,[3] or Roman Coriander, was called, in 1586,[4] by the Moors, *xamin, sunis* or *sunici;* in Italy, *melanthio* or *niella;* in Germany, *schwartz Kummel* or *schwartz Koriander;* in Spain, *neguilla* or *alipurie;* in France, *barbue poyurette* or *nielle.*

The modern names are: in France, *nigelle aromatique, cumin noire, epicerie, gith, graine noire, nielle, quatre-epices, senonge, toute-epice;* in Germany, *Schwartz-kummel, kohm;* in Flanders and Holland, *narduszaad;* in Spain, *nigela aromatica, neguilla;* in Italy, *nigella, comnella, melanzio domestico;* in Greece, *maurokoukatheis maurokoukki.*[5]

In Arab, *shoonez,*[6] *habbah sondeh* (*i.e.*, black seed), *kammoun asouad* (*i.e.*, black cumin);[7] in Bengali, *mugrela;*[6] in Burma, *sa-mung-net;*[5] in Ceylon, *kaloodooroo;* in Egypt, *hub-sindee;* in Hindustani, *kalajira;* in Persia, *siahdaneh;* in Sanscrit, *krishna-jiraka-musavi;*[6] etc.

French Szorzonera. *Picridium vulgare* Desf.

This salad plant is cultivated in Italian gardens, where it is much esteemed.[8] It is also used somewhat in France,[9] and was introduced into England in 1822. It is also of recent introduction into French culture.[10] In the United States it is noted by Burr[11] in 1863. The young leaves are the parts used.

It is called in France *picridie cultivee, cousteline, terra crepie;* in Italy, *caccialepre, terra crepolo.*[12]

Garlic. *Allium sativum* L.

The garlic is believed to be the *skorodon hemeron* of Dioscorides, the *skorodon* of Theophrastus and Aristoteles among the Greeks;

[1] Burr. Field and Gard., Pl. of Am., 1863, 429.
[2] Vick's Cat., 1884.
[3] Vilmorin. The Veg. Gard., 1885, 247.
[4] Camerarius. Epit., 1586, 551.
[5] Pickering. Ch. Hist., 141.
[6] Birdwood. Veg. Prod. of Bomb., 3.
[7] Delile. Fl. Æg., iii.
[8] Hort. Trans., vi., 583.
[9] Bon Jard., 1882, 549.
[10] Noisette. Man., 1860, ii., 422.
[11] Burr. Field and Gard. Veg., 390.
[12] Vilmorin. Les Pl. Plot., 407; Veg. Gard., 515.

the *allium* of Pliny and Palladius among the Romans. Among the Egyptians it was ranked among the gods in taking an oath.[1] On account of its objectionable odor it was avoided in Rome,[2] but it was probably eaten by the common people as now in southern Europe. It is mentioned in the earlier European herbals as in cultivation, and in England, in 1551, by Turner,[3] and in 1548 by Tusser.[4] In Peru, Acosta[5] says, in 1604, that "the Indians esteem garlike above all the rootes of Europe," and in Mexico, even earlier, Peter Martyn,[6] in 1577, noted its presence. It was in the garden of the Choctaw Indians, in North America, before 1775.[7] It is said to have been introduced to China 140–86 B.C.,[8] and to be found noticed in various Chinese treatises of the fifth, sixteenth, seventeenth and eighteenth centuries.[9] Louriero[10] found it under cultivation in Cochinchina. Two varieties are described by Vilmorin[11] in 1883, the common and the pink; and both were in American gardens in 1863.[12]

The garlic is called in France *ail ordinaire, theriaque des paysans;* in Germany, *gewohnlicher knoblauch;* in Flanders, *look;* in Holland, *knoflook;* in Denmark, *huidlog;* in Italy, *aglio;* in Spain, *ajo vulgar;* in Portugal, *alho;*[11] in Russia, *tschesnok;*[4] in Greece, *aglithia, gelgithia, shorton,*[13] *scordon.*[14]

In Arabic, *toum,*[15] *teriac-rowstyan;* in Bengali, *loshoon, lushoona, rushoon;* in Ceylon, *soodooloonoo;*[15] in China, *svon;* in Cochinchina, *cay toi;*[10] in Egypt, *tom;*[16] in India, *luhsun* or *bulbros;*[17] in Malaya, *buvung-pootie;* in Persia, *seer;* in Sanscrit, *mahooshooda;* in Hebrew, *schoum, schumin.*[14]

[1] Wilkinson. Ancient Egyptians, ii., 31.
[2] Unger. U. S. Pat. of Rept., 1859, 334.
[3] Miller's Dict., 1807.
[4] McIntosh. Book of the Gard., ii., 29.
[5] Acosta. Hist. of the Ind., 1604, 261. His first edition, 1590.
[6] P. Martyn. Eden's Hist. of Trav., 1577.
[7] Roman's Nat. Hist. of Fla., 1775, i., 84.
[8] Bretschneider. On the Study, etc., 15.
[9] Bretschneider. Bot. Sin., 78, 59, 83, 85.
[10] Louriero. Fl. Cochinch., 201.
[11] Vilmorin. Les Pl. Pot., 1883, 2.
[12] Burr. Field and Gard. Veg., 1863.
[13] Pickering. Ch. Hist., 145.
[14] Decandolle. Orig. des Pl. Cult., 51.
[15] Delile. Fl. Æg., iii.
[16] Birdwood. Veg. Prod. of Bomb., 249.
[17] Speede Ind. Handb. of Gard., 159.

Gherkin. *Cucumis anguria* L.

This vegetable is described by Marcgrav,[1] in Brazil, in 1648, the name *Cucumis sylvestris Brasileæ* indicating an uncultivated plant. Ten years later Piso[2] described it also as a wild plant of Brazil under the name *guarerva-oba* or *Cucumer asinius*, and gives a figure. It has also been found in the Antilles and continental tropical and sub-tropical America, New Granada and South Florida.[3] It is not mentioned as cultivated in Jamaica, by Sloane,[4] in 1696. Its fruit is mentioned as being used in soups and pickles, apparently gathered from the wild plant, by Long,[5] in 1774, Titford,[6] in 1812, and Lunan,[7] in 1814. It is, however, cultivated in French Guiana and Antiqua.[8] Although described by Ray,[9] in 1686 and 1794, and grown by Miller in his botanic garden in 1755, it yet does not appear as if in the vegetable gardens of England in 1807,[10] although it was known in the gardens of the United States[11] in 1806. In France it was under cultivation in 1824 and 1829,[12] but apparently was abandoned, and was reintroduced by Vilmorin in 1858.[3]

The *small girkin*,[13] *round prickly gherkin*,[11] *West India gherkin*, or *prickly fruited gherkin* is called in France *concombre des antilles, angurie, concombre a spines, C. d'Amerique, C. marron, C. comichon des Antilles, C. arada* (erroneously); in Germany, *west-indische Gurke*.[14]

I do not find mention of any varieties.

Globe Cucumber. *Cucumis prophetarum* L.

The flesh of this cucumber is scanty and too bitter to be edible,

[1] Marcgrav. Hist. Bras., 1648, 44.
[2] Piso. Hist. Bras., 1658, 264.
[3] Naudin. Am. des Sc. Nat., pp. 8, p. 12.
[4] Sloane. Cat. Jam., 1696, 103.
[5] Long. Jam., 1774, 801.
[6] Titford. Hort. Bot. Am., 1812, 100.
[7] Lunan. Hort. Jam., 1814, i., 254.
[8] Cogniaux. Cucurbitaceæ in D. C. Monog., iii., 501.
[9] Ray. Hist., 1886; Suppl., 1704, 333.
[10] Miller's Dict., 1807.
[11] McMahon. Am. Gard. Cal., 1806, 581.
[12] L'Hort. Fran., 1824; Noisette. Man., 1829, 353.
[13] Fessenden. New Am. Gard., 1828, 52.
[14] Vilmorin. Les Pl. Pot., 166.

says Vilmorin,[1] who includes it among the plants of the kitchen garden. Burr[2] says the plant is sometimes eaten boiled, but it is generally pickled in its green state, like the common cucumber, and adds that it is not worthy of cultivation.

Good King Henry. *Chenopodium Bonus-Henricus* L.

The leaves are eaten as a spinage. The plant is now but rarely cultivated. Gerarde speaks of it in 1597 as a wild plant only, while Ray in 1686 refers to it as frequently among vegetables, and Bryant in 1783 says formerly cultivated in English gardens, but of late neglected, although certainly of sufficient merit. In 1807 Miller's Dictionary says it is generally in gardens about Boston, in Lincolnshire, and is there preferred to spinage. It cannot have ever received very general culture, as it is only indicated as a wayside plant by Tragus, 1552; Lobel, 1570 and 1576; Camerarius, 1586; Dalechampius, 1587; Matthiolus, 1598; Chabræus, 1677, etc. Its value as an antiscorbutic finds recognition in its names, *Bonus-Henricus* and *tota bona.*

It is called in English, *Good King Henry, Fat-hen,*[3] *English mercury, All Good,*[4] *Wild* or *perennial spinage,*[5] *goose foot;* in France, *anserine bon-henri, bon-henry, epinard sauvage, patte d'oie triangulaire, sarron, serron;* in Germany, *gemeiner Gansefuss;* in Flanders and Holland, *ganzevoet;* in Italy, *bono enries.*[6]

It is recorded for American culture by Burr in 1863, and has now become naturalized about dwellings in a few localities. I have never observed it growing.

Gourd. *Lagenaria vulgaris* Ser.

See under Squash.

It is generally supposed that the Gourd is uneatable. This is true of some varieties, but not of others. Duchesne,[7] in France, speaks of the *trompette gourd* as edible. In ancient Rome recipes for cooking are given by Apicius,[8] and Pliny[9] speaks of their

[1] Vilmorin. The Veg. Gard., 1885, 227.
[2] Burr. Field and Gard. Veg., 1863, 179.
[3] Johnson. Useful Pl. of Gt. Brit., 216.
[4] Bryant. Fl. Dict., 1783, 62.
[5] McIntosh. Book of the Gard., ii., 137.
[6] Vilmorin. Les Pl. Pot., 1883, 9.
[7] Duchesne. Quoted by Decandolle. Geog. Bot., 898.
[8] Apicius. Lib. iii., c. 4, 7.
[9] Pliny. Lib. xix., c. 24.

being eaten, as does also Albertus Magnus,[1] in the thirteenth century. Cardanus,[2] in 1556, says the oblong gourd is edible, and J. Bauhin,[3] in 1651, says the same for two varieties. In India the gourd is said to be eaten, by Drury,[4] Firminger[5] and others; in China, by Smith;[6] in Cochinchina, by Loureiro;[7] in Egypt, by Forskal;[8] in Turkey, by Walsh,[9] etc.

A variety is in edible use in Japan, as I am informed by Mr. Tamari, and of which I have seen the drawings. In Mexico, a variety, as I am informed by Dr. Edward Palmer, is used to form a preserve known by the name of "angels' hairs," from the fibrous nature of the interior portion which is used.

Great-headed Garlic. *Allium ampeloprasum* L.

A mild plant, common in the countries bordering on the Mediterranean, especially in Algeria, and believed to be the native form of the cultivated Leek.[10] In 1568 Camerarius[11] speaks of it as cultivated in gardens, but this is not confirmed as a common course by the references in the *Adversaria*, 1570;[12] in Lobel's observations, 1576;[13] by Dalechamp, in 1587;[14] by Clusius, 1601;[15] by Dodonæus, 1616;[16] these authors referring to it only as a wild plant of the vineyards. In 1882, the *Bon Jardinier* says the country people of Southern Europe eat it raw, and this is the only known use. It is, however, included among garden esculents by Burr,[17] in 1863, and by Vilmorin,[18] in 1883. The description which has come down to

[1] Albertus Magnus. De Veg., Jessen ed., 1867, 499.
[2] Cardanus. De Rerum Varietate, 1556. 222.
[3] J. Bauhin. Hist., ii., 214, 217.
[4] Drury. Useful Pl. of Ind.
[5] Firminger. Gard. in Ind., 126.
[6] Smith. Mat. Med. of China, 128.
[7] Loureiro. Fl. Cochinch., 592.
[8] Forskal. Fl. Ægypt. Arab., 167.
[9] Walsh. Hort. Trans., vi, 56.
[10] Decandolle. Orig. des Pl. Cult., 81.
[11] Camerarius. Hort., 1588, 131.
[12] Pena and Lobel. Adv., 1570, 58.
[13] Lobel. Obs., 1576, 79.
[14] Hist. Gen. Lugd., 1587, 1549.
[15] Clusius. Hist., 1601, 190.
[16] Dodonæus. Pempt., 1616, 690.
[17] Burr. Field and Gard. Veg. of Am., 1863, 124.
[18] Vilmorin. Les Pl. Pot., 1883, 3.

us of the *ulpicum* of the Romans seems to indicate this plant. Columella[1] and Pliny[2] both say it is larger than the garlic; Columella, that the bulb is composed of many cloves, and that it is particularly loud-smelling. Vegetius[3] calls it the *Beticum ulpicum* or *Andulasian ulpicum*. Cato[4] speaks of its use in veterinary practice. Palladius[5] gives minute directions for its culture. If, however, cultivated in Italy, it seems not to have extended its area, but to have disappeared in later times, perhaps superseded by the leek.

The *great-headed garlic* is called in France *ail d'orient, ail a cheval, pourrat, pourriole;* in Germany, *pferde-knoblauch;* in Italy, *porrandello.*

Chabræus, 1677,[6] gives for names: German, *aberlauch, acker-knoblauch;* in France, *ail pourreau;* in Italy, *aglioporro.*

The synonymy in part is as follows:—

Scorodoprasum sive alliporrum. Adv., 1570, 58.
Scorodoprasum. Lob. obs., 1576, 79. Chabr., 1677, 201.
Scorodoprasum alterum. Lugd., 1587, 1549.
Porrum Indum. Cam. hort., 1588, 131.
Scorodoprason I. Clus. hist., 1601, 190.
Ampeloprasum primum. Dod., 1616, 690.
Scorodoprasum dictum J. B. Ray, 1688, 1121.
Allium ampeloprasum. Lin. sp., 1763.
Great round-headed garlic. Mill. dict., 1807.
Great-headed garlic.

Ground-nut. *Apios tuberosa* Mœnch.

This plant, a native of North America, and common in moist thickets, is included by Vilmorin among the plants of the kitchen garden, and worthy of trial. It is hence liable to appear at any time into American culture. The edible portions are the tuberous enlargements borne on the roots, and of the size of an egg or larger; these tubers are starchy, often of an agreeable flavor, and may be eaten like the potato.

In the colonial period the tubers of the wild plant were a

[1] Columella. Lib. xi., c. 3; lib. x., c. 112.
[2] Pliny. Lib. xix., c. 34.
[3] Vegetius. Lib. i., c. 18.
[4] Cato. C. 71.
[5] Palladius. Lib. xii., c. 6.
[6] Chabræus. Ic. et Sciag., 1677, 201.

resource against starvation. Thus Parkman[1] records that Biencourt and his followers at Port Royal, in 1613, were scattered about the woods and shores digging ground-nuts; and the Pilgrims during their first winter were enforced to live on them.[2] This plant was described and figured by Cornutus[3] in 1635, and is described by Clayton[4] in 1739. Although probably grown by Cornutus at Paris prior to 1635, yet it received no further attention until again grown in 1849,[5] and should it gain a foot-hold, its introduction would be scored to this latter date.

J. Hammond Trumbull thinks the *openauk* of Hariot,[6] found in Virginia in 1584, to be this plant, "a kind of root of round form, some of the bigness of walnuts, some far greater, which are found in moist and marish grounds, growing many together one by another in ropes, or as though they were fastened with a string. Being boiled or sodden, they are very good meate." Brereton,[7] in his account of Gosnold's voyage to New England in 1602, notes the "great store of ground-nuts" found on all the Elizabeth Islands. They grow "forty together on a string, some of them as big as a hen's egg." Champlain,[8] 1605–6, observed that the Indians about Nauset harbor probably had "force des racines qu'els cultivent, lorsquelles ont le gout d'artichaut," and it is to these roots that Lescarbot[9] alludes, west and south of Maine, "grosses comme naveux, tres excellentes a manger, ayans un gout retirant aux cardes, mais plus agreable, lesquelles plantus multiplient en telle facon que c'est merveille."[10] Kalm,[11] at a later period, 1749, states that it grows in the meadows along the Delaware, and the roots eaten by the Indians. He adds that the Swedish colonists eat them for want of bread, and that some of the English still eat them instead of potatoes.

[1] Pioneers of France, 274.
[2] Young. Chron. of the Pilg., 329.
[3] Cornutus. Canad. Plant. Hist., 1635, 200.
[4] Gronovius. Virg., 1762, 107.
[5] Heuze. Les Pl. Alim., ii., 548.
[6] Heriot. Hakl. Voy., iii.
[7] Brereton. Purchas., 1651, iv.
[8] Champlain. Voy., 1632, 84.
[9] Lescarbot. Hist. de la Nouv. France, 1612, 840.
[10] All quoted from Gray and Trumbull, Am. Jour. of Sc., May, 1877, 350, i.
[11] Kalm. Trav., 1770-1, ii., 96.

The Indian and other names that have been applied to this plant are as follows:—

English, *Ground-nuts,* Winslow,[1] *Wild Bean;* French of the western prairies, *pomme de terre;*[2] Carolina Indians, *scherzo;*[3] New Jersey Indians, *hopmiss* or *hopniss;*[4] Osage Indians, *taux;*[3] Sioux Indians, *modo;*[5] Virginia Indians, *openauk.*[5]

Hedgehog. *Onobrychis cristagalli* Lamk.

This singular plant is grown in vegetable gardens as a curiosity, on account of the peculiar shape of the seed pods. It has no utility. Its seed appears in some of our seedsmen's lists.

The *hedgehog* or *cockscomb sanfoin* is called in France *herrisson;* in Germany, *igel.*[6]

Hop. *Humulus lupulus* L.

As a garden plant the hop is nearly unknown in this country. In Belgium, however, the young shoots of the plant, just as they emerge from the ground, are used as an asparagus, and the plant is enumerated by Vilmorin among kitchen vegetables.[7] The plant is found in a wild state throughout all Europe, and extends also to the Caucasus, the south Caspian region, and through central and southern Siberia to the Altai mountains, and has been introduced into North America, Brazil and Australia.[8] As a plant for producing hops to be used in the brewing of beer it has long been in use. Hop gardens are mentioned as existing in France and Germany in the eighth and ninth centuries. In America they are noted in Virginia in 1649,[9] and were among the articles sent the Massachusetts company in 1629.[10] The first allusion that I find to the hop as a kitchen herb is by Cobbett,[11] in 1821, but the use of the young shoots is mentioned by Pliny[12] in the first century

[1] Winslow. Young's Chron. of the Pilg., 329.
[2] Dept. of Agr. Rep't, 1870, 405.
[3] Heuze. Les Pl. Alim., ii., 548.
[4] Kalm. Trav., 1770, ii., 96.
[5] Hariot, l. c.
[6] Vilmorin. Les Pl. Pot., 282; The Veg. Gard., 201.
[7] Vilmorin. Les Pl. Pot., 282.
[8] Pharmacographia, 1879, 551.
[9] A Perf. Desc. of Va., 1649, 3.
[10] Mass. Records, i., 24.
[11] Cobbett. Am. Gard., 1821.
[12] Pliny. Lib. xxic., 50.

as collected from the wild plant, rather as a luxury than as a food. Dodonæus,[1] in 1616, refers to the use of the young shoots, as collected apparently from the hop yard, as does also Camerarius,[2] in 1586, and others.

The hop is called in France *houblon;* in Germany, *Hopfen;* in Flanders, *hop;* in Italy, *luppolo;* in Spain, *lupulo, hombrecillos;*[1] in Tartar, *kumalak;* in Hungarian, *comlo;* in Sweden, *humle;* in Denmark, *homle.*[3]

Horehound. *Marrubium vulgare* L.

This plant affords a popular domestic remedy, and seems in this country to be an inmate of the medicinal herb garden only. In Europe the leaves are sometimes employed as a condiment. Although a plant of the old world, it has now secured naturalization in the New World from Canada to Buenos Ayres and Chili, excepting within the tropics.[4] It is figured by Clusius,[5] in 1601, and finds mention by many of the botanists of that period.

Horehound is called in France *marrube blanc;* in Germany, *andorn;* in Italy, *marrubio.*

Pliny[6] refers to the *Marrubium,* among medicinal plants in high esteem, and it finds mention by Columella.[7] Albertus Magnus,[8] in the thirteenth century, also refers to its valuable remedial properties in coughs. We may hence believe that as a herb of domestic medicine it has accompanied emigrants into all the cooler portions of the globe.

Horseradish. *Cochlearia armoracia* L.

This plant cannot be identified with certainty with the *Armoracia* of the Romans.[9] If it be the *armoracia* of Palladius,[10] which is a wild plant transferred to the garden, it is very curious that its use

[1] Dodonæus. Pempt., 1616, 609.
[2] Camerarius. Epit., 1586, 934.
[3] Pickering. Ch. Hist., 620.
[4] Decandolle. Geog. Bot., 751.
[5] Clusius. Hist., 1601, ii., 34.
[6] Pliny. Lib. xx., c. 89.
[7] Columella. Lib. x., c. 356.
[8] Albertus Magnus. De Veg., Jessen ed., 1867, 539.
[9] Decandolle. Orig. des Pl. Cult., 27; Pharmacographia, 1879, 71.
[10] Palladius. Lib. iv., c. 9; lib. xi., c. 2; lib. xii., c. 6. Palladius flourished about 210 A.D.

is not mentioned by Apicius,[1] in his work on cookery, of the same century. Zanonius[2] deems the horseradish to be the *draba* of Dioscorides. It seems to be the *raphanus* of Albertus Magnus,[3] who lived in the thirteenth century, and he speaks of the plant as wild and domesticated, but its culture then was probably for medicinal purposes alone, as indicated by him. Its culture in Italy in 1536 is implied by Ruellius[4] under the name *armoracia*, but Castor Durante,[5] in 1617, does not describe it. In Germany its culture as a condimental plant is stated by Fuchsius,[6] in 1542, and by later writers. In 1587 Dalechamp[7] states its culture in Germany, but does not mention it in France. Lyte,[8] in 1586, mentions the wild plant, and its uses as a condiment in England, but does not imply culture; but in 1597 Gerarde[9] states that it is in gardens. It was observed in the gardens of Aleppo by Rauwolf[10] in 1573–5. It was in American gardens previous to 1806,[11] and is now a plant of market garden culture.

Horseradish is a plant of many names. It is called in France *raifort sauvage, cran de Bretagne*, etc., etc.; in Germany, *Meerretig;* in Flanders, *kapucienen mostaard;* in Holland, *peperwortel;* in Denmark, *peberrod;* in Italy, *rafano:* in Spain, *taramago, vagisco;* in Portugal, *rabao de cavalho;*[12] in the north of England, in 1568, *red cole.*[13]

Hyssop. *Hyssopus officinalis* L.

This aromatic plant was formerly in more request than at present Its young shoots and leaves are sometimes used as a condiment, but it rather belongs among medicinal herbs. In 1597 Gerarde[14] fig-

[1] Apicius Cœlius. De Opsoniis, etc., 1709. Apicius flourished about 230 A.D.
[2] Zanonius. Stirp. Hist., 1742, p. 23, t. 15.
[3] Albertus Magnus. De Veg., lib. vi., tract 2, c. 16.
[4] Ruellius. De Nat. Stirp., 1536, 466.
[5] Castor Durante. Herb., 1617.
[6] Fuchsius. De Stirp., 1542, 660.
[7] Hist. Gen. Lugd., 1587, 636.
[8] Lyte. Dodœns, 1586, 688.
[9] Gerarde. Herbal, 1597, 187.
[10] Gronovius. Orient, 80.
[11] McMahon. Am. Gard. Cal., 1806.
[12] Vilmorin. Les Pl. Pot., 1883, 536.
[13] Pharmacographia, 1879, 71. Gerarde. Herb., 1597, 187.
[14] Gerarde. Herb., 1597, 464.

ures three varieties; in 1683 Worlidge[1] names it among culinary herbs in England, but says it is more valued for medicine; in 1778 Mawe[2] describes six varieties, and says generally cultivated in the kitchen garden, and in 1806[3] McMahon includes it in his list of kitchen aromatics for American gardens. It is mentioned among European garden plants by Albertus Magnus[4] in the thirteenth century, and in nearly all the later botanies, Ray[5] enumerating it as also an ornamental plant, in nine varieties. As an ornamental plant is it yet deserving of notice, but its present use in American gardens must be very limited. It is mentioned by Paulus Ægnita,[6] in the seventh century, as a medicinal plant.

Hyssop is called in France *hyssope;* in Germany, *Isop;*[7] in Flanders and Holland, *hijsoop;* in Denmark, *isop;* in Italy, *issopo;* in Spain, *hisopo;* in Arabic, *zoofoe yeabus, ushnaz-daoud.*[8]

EDITORS' TABLE.

EDITORS: E. D. COPE AND J. S. KINGSLEY.

There can be no "privileged classes" among scientific workers. As the exact truth is the object of their labors, personal authority does not exist for them except in so far as the reputation of a man for accuracy will sustain his assertions, where the evidence cannot be obtained from the subject-matter itself. It is dangerous for a man holding a superior place in a scientific laboratory or museum to require subscription to his views on the part of his subordinates apart from their conviction of their truth, since if there be error, it is thus all the more widely advertised, and the hostile criticism is the more general. It is dangerous for subordinates to adopt views on the strength of authority alone, unless means of verification are

[1] Syst. Hort., by J. W. Gent, 1683, 220.
[2] Mawe. Gard., 1778.
[3] McMahon. Am. Gard. Kal., 1806.
[4] Albertus Magnus. De Veg., Jessen ed., 1887, 581.
[5] Ray. Hist., 1686, 516.
[6] Paulus Ægenita. Bruns. ed., 1531, 68.
[7] Vilmorin. Les Pl. Pot., 283.
[8] Birdwood. Veg. Prod. of Bomb., 62.

wanting. Nor has science anything to do with national prejudice. There can be no English, no French, and no German schools. Investigation makes all things even, and credit will be awarded to priority wherever the work be done. But there is another kind of "privilege" which is more insidious, and against this the real producers in the scientific field cannot too fully protect themselves. This is the assumption of credit for work not done, by the appliances of art and other means at the command of wealth. The scientific pretender who introduces names without definitions, or the wealthy man who publishes pictures, and claims to have made scientific discoveries on the strength of the work of an artist only, may make a considerable popular reputation. The man who in ordinary print only, claims discoveries not his own, is easily disposed of; but if he fortify himself with new classical expressions or with good pictures, he produces an impression, even among men of science, who are not familiar with the facts. This is especially true of those publishers who can employ good artists. Such is the effect of a pretty picture on the average naturalist, that one begins to question whether after all science is not a branch of art, and the true scientists are the artists. Of the value of good illustrations we make no question, but that they can set aside analytical scientific descriptions is a proposition that none but some highly "privileged" person can possibly make. Illustrations on a large scale can be furnished but slowly in some parts of the world, owing to their cost; and in other cases owing to the very large amount of material to be figured. In such cases the scientific results cannot be withheld; and descriptions without figures will, and, if they are good, ought to precede the illustrated works. To ignore such work is only the part of indolence; and none but "privileged" persons can afford to be indolent. It has always been the way of this class to enter in and divide the spoil; but science recognizes no proprietary rights. Such persons and their admirers talk grandiloquently of the disinterestedness of the true man of science, and of the sublime indifference to all personal questions which possesses him. But we have always noticed that these very persons resent highly any invasion of their self-assumed privileges; and they are right, in so far as any credit which inheres in them is not granted by others. Scientific, like other men, must live, and their reputation

is the basis of their livelihood. They should then, and in the long run will, refuse to grant especial privileges to either position or wealth, but will expect work to be rewarded by recognition, and will rigorously exclude pretensions based on art or mere nomenclature. This they will do as necessary self-preservation, whenever the tendency may be in an opposite direction.

We regret to read in our esteemed contemporary, the *American Geologist*, an editorial apology for what most scientific men disapprove. We refer to the purchase of the scientific work of a man and the publication of it by the purchaser as though it was his own production. While this kind of a contract is perhaps legal, it is disreputable to the purchaser. A man under necessity for the means of a livelihood may make such a sale of himself without blame; but the man who buys, cannot in this way get a sound scientific reputation. Works of art placed before the public in this way, have been the cause of prosecution of a charge of false pretence against the pseudo-producer. We refer to the Belt case in London, where busts sold as the work of Belt were found to have been purchased by him from the real artist. Belt was mulcted in damages by the court after a trial which attracted much attention. But whatever the law may be, the moral obliquity and intellectual poverty that such a transaction implies on the part of the purchaser, are too plain for dispute.

RECENT LITERATURE.

BAUR'S MORPHOGENY OF THE CARPUS AND TARSUS OF THE VERTEBRATA.[1] — The first portion of Dr. Baur's work upon the above subject deals with the Batrachia, excluding the Salientia; the second will treat of the Sauropsida; the third of the Mammalia. The orders of Batrachia accepted are the Ganocephala of Owen; the Rhachitomi, Embolomeri, and Stegocephala of Cope; the Proteida, Urodela, and Anura. To the Ganocephala belong the most ancient of four-footed vertebrates, but Archegosaurus

[1] Beiträge zur Morphogenie des Carpus und Tarsus der Vertebraten, von Dr. G. Baur. I Theil. Batrachia. Jena, Verlag von Gustav, Fischer.

alone furnishes data for the elucidation of the subject. Like Eryops this genus has five digits on the fore foot. The incomplete remains of this genus lead to the conclusion that the Ganocephala possesses more elements in both carpus and tarsus than are possessed by any other Batrachians (Salamandrella perhaps excepted), and that the carpus was very similar to the tarsus. To the Stegocephala belong the oldest forms of Batrachia, and in these the number of five digits is already usual. The carpus and tarsus of Necturus each consist of six elements in the adult; while in Cryptobranchidæ (Urodela), both in the American and Asiatic species, the carpus has eight, and the tarsus ten elements. The author puts into tabular form the various changes which occur in the number of the tarsal and carpal bones during growth, and gives examples drawn from all the urodelous families, characterizing each primitive element by a letter or number, and tracing the separations and incorporations of each with its neighbors. These tarsal and carpal tables are followed by a table of the number of the digits in various existing and extinct Batrachia. The rudiment of a sixth digit occurs in the Cryptobranchidæ and Amblystomidæ.

Of the three possible modes of origin of the digitated limb (Cheiroterygium): from the fin-form, viz., development from a many-rayed fin; development from a few-rayed fin that has been formed by the obsolescence of the greater part of the rays of a many-rayed fin; and entire sprouting off from a form which had entirely lost its finned extremities. Dr. Baur declares that neither embryology nor palæontology are favorable to the first. All that can be asserted with precision regarding the ancestral form of the Stapedifera is, says our authority, that, since all save strongly modified members of this group have a single bone in the first series of the limbs (humerus, femur), and two bones in the second series (radius, ulna; tibia, fibula), so the ancestral form must also have had a single ray in the first series, and two rays in the second series. If the two rays of the ancestral form ended each in a single ray, the remaining three digits of the pentadactyle extremity must have been developed by sprouting; but if the primitive form possessed five digits, the remaining three must represent the last remains of a many-rayed fin. As facts which seem to lend support to the sprouting theory (already advanced by Bruhl) Dr. Baur instances: (1) the secondary division of the rays of the Ichthyopterygia; (2) a case of the division of the one-rayed fin of Protopterus, noticed by Albrecht; (3) the development and regeneration of the extremities of the Urodela. When the development of the fins of Ceratodus and Protopterus have been studied; when that of such extremities as normally possess two centralia has been worked out; and when the few-toed extremities of Proteus are fully understood, a great step will have been made towards the solution of the problem. The treatise of Dr. Baur is the most complete

review of the subject yet written, and clears the way for future discoveries.—*E. D. C.*

CLAUS'S ZOOLOGY.[1]—The new edition of the "Lehrbuch" of Dr. Claus is much improved over its predecessors, and it stands to-day the best accessible text-book. The illustrations have been increased in number (there are 792), while much new matter has been incorporated in the pages. As in the first edition, the taxonomy of the Vertebrates remains the poorest portion of the work. American authors have been drawn upon, but it is noticeable that the author does not notice the views of Brooks upon the development of Salpa, while a serious error occurs in the text of the Crustacea where Packard's term Paleocarida is used for Nebalia instead of Phyllocarida, which Packard gave to the group. Notwithstanding Bateson's researches, of which no mention is made, Balanoglossus still retains a place near the Echinoderms; in fact, the casual reader would infer from the "make up" that Dr. Claus regarded them as members of the same order as Synapta and Chirodota. The price of the volume (18 marks) is quite reasonable in comparison with that charged for the English translation.

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GENERAL NOTES.

GEOGRAPHY AND TRAVEL.[1]

ASIA.—INDO-CHINA.—M. de Lanessan, in a paper read before the Commercial Geographical Society of France, gives the area of French Indo-China at about 600,000 square kilometres. The Mekong, though the largest river of the peninsula, passes through a thinly peopled and almost uncultivated region until it enters Cambodia. The principal centres above this point are Luang-Prabang in the north; Nong-Kay, in the southward bend of the Mekong; Lakhone, in the rear of the Annamite provinces of Hatinh and Nghe-An, and largely colonised by Annamites; Bassac, in a navigable reach opposite to the mouth of the Se-Moum, which enters the Mekong from Central Siam; and Tsung-Treng, below the Khong rapids. The lower portion of the Mekong valley, that of the Donai, and the valleys of the numerous small rivers which descend on the eastern side of the mountains that separate Annam from the interior, are rich, cultivated, and well peopled. Tonquin has a veritable winter from October to March, characterised by heavy fogs and fine rain, but farther south the climate changes with the monsoons. Throughout the entire region the mountainous and wooded districts are less healthful than the rice-flats. Roads cannot be said to exist as yet, except immediately around some of the administrative centres. There is a costly railroad, on which as yet not a single car-load of merchandise has passed, from Saigon to Mytho. The Annamites in former times dug many canals, which though for awhile kept up by the French, are now almost entirely abandoned. The Donai is the only river of the region that can be entered by large vessels, and a coral bank obstructs even this. The Bay of Touraine, the port of the province of Quang-Nam, south of Hue, is a safe and ample harbor; and that of Ha-Long, in the north of Tonkin, seems to be equal to it.

According to Mr. McCarthy, Superintendent of Surveys in Siam, two spheres of influence, English and Siamese, are prominent in the Malay peninsula. The inhabitants of the northern portion are Siamese and Chinese, then come the SamSams, a mixture of Malays and Siamese, who are Buddhists and speak a mixed language; then the Malays, who are Mohammedans.

There are also two very curious tribes which are supposed to be aboriginal, called by the Malays "Orang Utann," or wild men,

[1] Edited by W. N. Lockington, Philadelphia, Pa.

and also known as Sakais and Samangs. The Sakai has soft black skin and wool; the Samang has also a very black skin, but the hair is coarse and straight, and the skin is rough. They wear no clothes, are clever in snaring fish and game, and use bows and arrows as well as blow-pipes for weapons.

KURDISTAN.—M. N. Binder recently described his travels in Kurdistan before the French Geographical Society. The name Kurdistan is given by the Turks to a collection of villages in the mountainous district separating Persia from Turkey, between 34° and 40° N. Laritude and 38° and 46° E. Longitude. Lakes Urmiah and Van are situated in the centre of immense table lands, the former, on account of its small depth and the extreme density of its waters, which are six times more saline than sea-water, does not seem to have a great future before it, but the latter lake offers many advantages. M. N. Binder traced the history of the Kurds, and referred to the current tradition that they have French blood in their veins. The variety of religions is the cause of infinite variety among the tribes. The sedentary and nomadic Kurds differ greatly in occupation and mode of life. The Subbas are a strange sect, with a religion composed of a mixture of gnostic and Christian ideas.

THE NEW SIBERIAN ISLANDS.—A recent number of Petermann's *Mitteilungen* contains a map of the new Siberian islands, giving the routes of Dr. Bunge, Baron Toll, Captain de Long, Nordenskiöld, etc. The principal islands are Ostrow Blischnij, Kotelnoi, Faddejewskoi, and East New Siberia.

North of these lie Bennett Land and Sannikow. Remains of the mammoth, narwhal (probably two species), horse, musk-ox, three kinds of deer, hare and seal were found upon the island of Ljachof (Ostrow Blischnij).

THE HITTITES.—It is probable that the renowned Hittite city Carchemish, is to be sought at the site of Jerablûs, from which the British Museum obtained a few years ago most of the Hittite monuments in its collection. The heads sculptured in these Jerablûs monuments are in many cases adorned with a queue or pig-tail identical in shape and position with that worn by the Chinese. The wearers of the pig-tail have Mongolian countenances, and it seems probable that a Mongolian race had obtained the supremacy in some of the Hittite cities.

AFRICA.—THE NIGER.—The French newspaper *Le Temps* contains an account of the voyage of the gunboat Niger from Bammako to Korium, the port of Timbuktu. The journey occupied three months. The Niger left Manambugu (thirty miles below Bammako) on July 1st, and twelve days later reached Diafarabu. Below

this point the country was unexplored, forming part of the States of Tidiani, the chief of Macina.

Bandiagara, Tidiani's capital, is a most important centre of the Mohammedan religion, the town resembling a huge convent. Farther down the river it became difficult to get provisions, since the natives had all retired into the interior. On July 9th, Lake Dheboë was entered, and was found to receive the river Koli-Koli, which waters the province of Formagha. Below Lake Dheboë the Niger takes the name of Bara Issa, and its banks are thickly lined with populous villages. Tidiani had issued strict orders to the Puls and Bambaras to have no communication with the French. The waters are shallow near Timbuktu, so that the gunboat could not proceed to the town. The *djemaa* or associations of merchants have been expelled two years before, and a chief named Rhiaia had been installed by the assistance of the Tuaregs. Knowing the perfidious character of the Tuaregs, the party slept on board every night, and made no excursions into the interior. All negotiations with the chiefs failed, and the Niger returned *via* the Diaka, or western branch of the river, hitherto unexplored. A vast amount of ethnographical and other valuable information was obtained, and a detailed survey of this part of the Niger's course was executed.

Derivation of the Name Congo.—According to Herr Jankó, the name "Congo" is identical with "Songo," and also with "Rongo," and signifies a "spear" in the speech of the Kijangi. The Bakongo were the first people who applied this name to the river, and it is certain that they came from the north and that their language has altered considerably since they separated from their northern progenitors. As it would be easier for a new people to adopt a name already given than to make a new one, it is probable that though in Kijanyi Congo means a spear, in the remainder of the Bantu tongues the word has somewhat changed its original signification, and become a proper name. Bakongo means "a man with a lance," and thus the river name may be interpreted to mean "quick as a lance."

J. Menges' Journey Southward from Kassala.—J. Menges publishes an account (Petermann's *Mitt.*) of his journey between Kassala and the Setit. The very existence of Kassala depends upon the commerce with the countries to the south of it. Two caravan routes conduct southwards. One of these follows the Atbara as far as Tomat, and then crosses the steppe to Kedarif. The second goes directly from Kassala to the Setit, passing by the imposing granite mountain of Kassala.

The people of these regions, belonging to the tribes Homran, Dabaina, and Schukpieh, dwell in the dry season on the borders of

the rivers or in market towns like Kedarif. The character of the three rivers Setit, Atbara and Basalam is everywhere the same; their flood plains are some 90 metres below the barren soil of the plateau, and they are themselves from 120 to 300 metres wide, and about 15 metres deep.

AUSTRALIA.—Dr. K. V. Lendenfeld (Petermann's *Mitt.*, 1888) states that the influence of forests upon the climate of Australia is the reverse of that which they are supposed to exercise in Europe. While European trees retain much of the water among their roots, the plants of the Australian wastes, including the grasses, Eucalypti and the Spinifex, send their roots to great depths in search of water, and appear to open their stomata only at night.

Dr. Lendenfeld asserts that during his journeys in the interior of New South Wales he has many times travelled all day through forests without seeing grass. The soil, for the most part consisting of red loam, is flat and smooth as asphalt, and hard as stone, forming a marked contrast to that of European forests. When it rains in such a forest the greater part of the water runs off into the hollows at once. As many of these water-holes have a subterranean communication with the sea, no great lakes are formed. The greatest river in Australia, the Murray, is navigable only in winter by flat-bottomed steamboats. In many places where squatters have destroyed the forests the bare soil becomes clothed with so many kinds of grass as to afford subsistence for a thousand sheep where a hundred fed previously.

Mr. S. Brooke (Petermann's *Mitt.*, 1888) describes the recent excursion of himself and his brother in Western Australia, and gives a map of their route. The whole region is lacking in water, yet has numerous plants. The soil is calcareous, with a few mountains and granite rocks rising from the plains. Among these is Mount Rugged, which is about 1,980 feet high and three miles long.

AMERICA.—Among valuable maps recently issued are those contained in the work of Sr. J. Albarracin, a member of the last Argentine exploring expedition in Patagonia, and showing the courses of the Negro, Limay and Collon-Cura and the Lake Nahuel-Huapi, of which the Limay is the outlet. This lake is 583 metres above the sea, and its shape is different from that originally reported.

The Argentine Republic in general may be said to consist of the flat Pampas and of the Cordilleras, but there are also subordinate chains which rise out of the Pampas, and others in front of the main Cordillera. The Pampas incline towards the southeast, and some of the peaks which rise in their midst reach a considerable

height, as, for example, Nevado de Famatina (6,024 metres) and Nevada de Aconquija (5,400 m.): toward the south these Pampas sierras diminish in height.

The province of Santa Fe (Argentine Republic), according to the census of June 8, 1887, now contains 220,332 inhabitants, against 187,000 in 1869. The municipality of Córdoba, a square of 26 kilometres on each side, contained in October of the same year 66,247 souls, while in 1869 it had but 34,458. Buenos Ayres has now a population of 424,873, and Rosaria 50,914.

GEOGRAPHICAL NEWS.—ALGERIA.—The last census (1886) of Algeria gives a population of 3,752,196, being an increase of nearly half a million above the population in 1881. Of this increase 24,209 are Frenchmen, and nearly 22,000 natives of other European countries. There has been an influx of more than 17,000 Moroccans into Algeria, while Mohammedan-French subjects have increased from 2,842,497 to 3,264,481.

According to Mr. N. J. Dixon, the population of the various States of Colombia is as follows: Boyaca, 483,874; Cauca, 435,690; Santander, 423,427; Cundinamarca, 409,602; Antioquia, 365,974; Bolivar, 300,000; Tolima, 230,821; Panama, 220,600; and Magdalena, 85,255; making a total of 2,955,243.

GEOLOGY AND PALÆONTOLOGY.

NOTES ON THE ROCKFORD SHALES.—The lithological and palæontological characters of the Rockford shales of Iowa differ considerably at different localities.

For example, the shales which are seen at the south exposure at Owens Grove, Cerro Gordo county, differ conspicuously, in many respects, in their lithological and palæontological characters, from the same beds observed at other localities.[1] The differentiation of the fauna at this place is strongly marked. The three species of Pachyphyllum[2] which occur at Hackberry and Rockford, are here replaced by a new species of this genus.

[1] For a detailed description of the Rockford Shales, and the limestone which immediately underlie them, reference may be made to a paper by the author, on "Contributions to the Knowledge of the Devonian Fauna of Iowa, with a Description of the Rockford Shales," now in press by the Davenport Academy of Science.

[2] In a paper, now in the hands of the printer, the author has described three new species of this genus.

The species *Cystiphyllum davidsonii*,[1] which occur here in considerable numbers, also entirely replace *Acervularia inequalis*, of other portions of these beds. The Stromatoporoid forms, which occur at other localities, are here replaced by a single, undetermined species of this genus. Specimens belonging to the following genera are also found here, but are not known to occur elsewhere in the shales. *Pleurotomaria*, *Saxonema*, *Syringopora*, *Alveolites*, *Gyroceras*, etc.

In connection with these, we have obtained large numbers of new, and described, species of Lamellibranchs, which do not occur (or if so, in small numbers) elsewhere in this formation.

But the chief interest attaches to a certain very large, and undetermined species of Trilobite, which occurs here, and entirely replaces all other species of crustaceans which are known to occur at Hackberry and Rockford. The occurrence of this species in these beds is a matter of considerable interest, from the fact that it is the first instance of the known occurrence of any of these forms in the Rockford shales and indeed, in any of the Devonian rocks of northern Iowa.

The great variation in the lithological and palæontological characters of the shales at this place, from those observed at an exposure one and one-fourth miles to the north, as well as those at Hackberry and Rockford, led us at first to doubt their equivalency. But subsequent collections showed a considerable number of typical Rockford shale species (as shown by the following list), which prove them to be equivalent to other portions of this formation, as observed at other localities. The following enumeration is that, of some of the typical shale forms occurring here.

Spirifera whitneyi, *Spirifera hungerfordi*, *Atrypa hystrix*, var. *planosulcata* Webster, *Strophodonta reversa*, *Strophodonta canace*, *Campophyllum nanum*, *Zaphrentis solida*, *Cystiphyllum mundulum*, and *Naticopsis gigantea*. Although the number of species represented is considerable, yet their occurrence in individual numbers are usually small.

Loxonema gigantea, n. sp.—Shell large, cylindrical, sloping rapidly from the blunt apex. Length of adult individual from ten to thirteen and one-half centimetres. Volutions from six to seven, rather strongly convex at or below the centre, the last one strongly inflated, very oblique. Suture strongly defined; aperture circular or nearly so; shell thick, surface marked by minute curved striæ. This species more closely resembles *L. robusta*, of Hall (15 Regents Report of New York, p. 52) than any other described species known to me. It differs, however, from that species in that the

[1] This variety approaches more nearly the form from Alpena, Mich., than to those from any other portion of the Devonian rocks of Iowa. Only two specimens of this species have ever been obtained (so far as known to me) from any other portion of this formation.

shell is larger, the apex more blunt, the greater obliquity of the volutions, and in their greatest convexity being at or below the centre. Position and locality, Rockford shales, Owens Grove (south exposure), Cerro Gordo county, Iowa.

Loxonema owenensis, n. sp.—Shell very large and robust, subconiform; spire rather rapidly ascending, apex blunt. Volutions eight to ten or more, very oblique, strongly inflated, most prominently so below the centre, rounded. Suture deeply channeled; shell from two mm. to six mm. in thickness; aperture subovate. Surface apparently smooth. The depth of the suture in this species is very much greater than the suture in either the foregoing or following species. Height of adult specimens from fourteen to sixteen and one-half centimetres; diameter of body volution from four to five centimetres. This is, we believe, the largest species of the genus yet described. Position and locality, Rockford shales, Owens Grove (south exposure), Iowa.

Loxonema crassum, n. sp.—Shell large, subconiform depressed, rapidly broadening from the blunt apex. Volutions from five to seven, slightly flattened or broadly rounded; suture strongly channeled below; shell very thick; surface apparently smooth; aperture ovate. This species differs from *L. gigantea* in its more robust, depressed form, and the less convexity and obliquity of its volutions. Position and locality, Rockford Shales, Owens Grove (south exposure), Iowa. Quite a large number of specimens of each of the species described have been secured, and their specific differences are shown to be constant and well marked.—*Clement L. Webster, Charles City, Iowa.*

Some Extinct Scleroderms.—In 1887, in the *Memorie della Societa Italiana delle Scienze* of Naples (3d series, v. 6, No. 4),[1] Baron Achille de Zigno has published descriptions and illustrations of two very interesting Scleroderms from the Eocene beds of Italy. One of these is the *Protobalistum imperiale* of Massalongo, the other a previously unknown species considered to be congeneric with the former and named *Protobalistum Omboni;* both were obtained from the celebrated Mount Bolca beds. The most casual examination will convince one who has had much experience with recent fishes that the two species have little in common and belong to very different genera if not families. Both are, however, important for the light they may throw on the genetic relations and former distribution of the Scleroderms, but each owes its importance to a different reason.

The generic description of *Protobalistum* given by Baron de Zigno is based on the assumption that there are certain characters

[1] Due nuovi pesci fossile della famiglia dei Balistini scopertinel terreno eoceno del Veronese. (8 pp., 2 pl.)

which are common to the two forms, which does not appear to be justified by the specimens; on the development of 4 to 6 dorsal spines, of spinous rays to each pectoral ("pectorales radiis duobus spinosis"), and of 1 to 3 spines to each ventral ("ventrales radiis 1—3 spinosis, retro-flexis"). Such features as the last two are so incompatible with the structure of living Scleroderms that the suspicion is unavoidable that their ascription to the extinct forms is due to some error of observation or interpretation. The principal feature described and corroborated by the illustrations is the number of dorsal spines. The arrangement of the spines is nevertheless very different in the two species.

The typical *Protobalistum* (*P. imperiale*) has six (or seven) dorsal spines, rather widely separate from each other, extending from over the eye far back upon the posterior half of the body, and very elongate (the foremost especially); the soft dorsal as well as anal are very short. No pectorals and ventrals are represented in the figure, although it is asserted that there is a ventral spine.[1] The character of the dorsal fin is very different from that exemplified in any of the Balistids or Triacanthids. None of the Balistids have more than three dorsal spines, and all having that number have the second close behind the first, and modified to lock it in erection, in such a manner as to have obtained for the species the name Trigger-fish. The *Protobalistum* should therefore be apparently considered as the type of a peculiar family with generalized characters and allied to the progenitors of the Siganids and Teuthidids; the family name in such case would of course be *Protobalistidæ*.

The so-called new *Protobalistum* (*P. Omboni*) has four dorsal spines moderately approximated and confined to the forward part of the back; the first spine is very strong and the others very short; the soft dorsal is elongated, and the anal is oblong; the caudal peduncle is long. In fact, the species has the physiognomy as well as the structural characteristics (so far as known) of the Triacanthids, and there appears to be no reason for doubt that it belongs to that family, and that it is related to the genera *Triacanthodes* and *Hollardia*, with which it agrees in the convex caudal fin, and perhaps the development of one or two axillar rays, besides the elongated ventral spines. ("Le ventrali sono constituite da tre soli raggi spinosi rivolti all' indietro e addentellati nei loro margini, di cui il primo e lungo 27 millimetri, il secondo 25 el il terzo 20, e cadauno alla base ha il diametro di 2 millimetri.") The caudal fin is very large, and has a convex posterior margin, thus differing from that developed in the Triacanthinæ. No generic

[1] Delle pettorali non si scorge sull 'esemplare alcuna traccia e delle ventrale si vede soltanto un solo raggio spinoso lungo tre centimetri ripiegato all 'indientro lungo il ventre (p. 4).

name being available for the fossil, it may be named *Protacanthodes Omboni*, the name recalling that the foremost elements of the spinous dorsal as well as ventrals are enlarged spines, as well as that it is a forerunner of the Triacanthids. It differs from *Hollardia* and *Triacanthodes* in the oblong caudal peduncle and enlarged caudal fin while its physiognomy rather recalls the true *Triacanthi*. The occurrence of a form so closely related to the *Triacanthodes* of the Japanese sea, and to the *Hollardia* of the Caribbean in the eocene seas of Europe, is worthy of special note, and this is a sufficient reason for the present communication.

The nearest extinct associate of *Protacanthodes* is not *Protobalistum* but *Acanthopleurus* Ag. The two belong to the same family but appear to be otherwise distantly related. The other extinct genera of Scleroderms, *Balistomorphus* Gill, *Acanthoderma* Ag. 1843, not Cantraine, 1835, and *Bucklandium* Koenig—*Glyptocephalus* Ag.) are rather to be associated with the Balistids.

The exact characters and relations of all these fishes remain to be known.—*Theo. Gill.*

THE PHYLOGENY OF THE HORSES.[1]—This brochure of 71 pages, illustrated by two excellent plates, cannot fail to instruct the student who is unfamiliar with this subject. The authoress shows a great degree of familiarity with the history of the facts known in this connection and they are set forth with considerable fulness of detail. She has been more fortunate than some of her predecessors in avoiding record *in extenso* of the mythology of the subject, which has been long since consigned to its place in the waste-basket by American palæontologists. We allude to the Eohippus, Miohippus, and Pliohippus, which still appear occasionally in theological works and school-books of America and England. A considerable part of the essay is devoted to the endeavor to prove that the genera Palæotherium and Hippotherium must be excluded from the line of descent, which has continued from *Protogonia puercensis* through Phenacodus, Hyracotherium, etc., to Equus. She describes and figures with much care certain bones of the carpus and tarsus of Anchitherium, Hippotherium, and Equus, in evidence of this position as regards Hippotherium. We say with reference to this question, that in discussing the phylogeny of *genera*, one must confine himself to *generic characters*, and it is necessary to ascertain what these are in the skeleton before we can use them properly. There are some species of supposed Hippotherium of North America which approach Equus so closely in dental characters that the descent of some species of the latter from them looks probable. Probably the species of Equus are polyphyletic,[2] some coming from

[1] Etudes sur l'Histoire Palæontologique des Ongulés, II, le Developpement des Equidæ. Par Marie Pavlow. Moscow, 1888.

[2] I have expressed this opinion in an article on the Perissodactyla in American Naturalist, 1887, p. 1075.

Hippidium and some from Hippotherium through the intermediate form with the molar teeth of the latter genus, and the single metapodials of the former. This genus has not been named, and I will now call it *Hippodactylus*, and give as the type *Hippotherium antelopinum* of Falconer from the Sivalik formation of India. It enters the Equidæ.

We find in this essay two new family names, whose introduction we regret. One of these is the "Hyracotheriidæ," which is perhaps a misapprehension of my own Hyracotheriinæ. This group cannot be separated as a family from the Lophiodontidæ so far as I can see. The other family name is Pachynolophidæ. Pachynolophus was based by Pomel on the *P. duvali*, which is an undoubted member of the family Lophiodontidæ, if the figure of Pictet (Traité de Palæontologie) is correct, and I believe it to be so after examination of specimens in Paris. But Lydekker and Pavlow place in this genus the *Hyracotherium siderotilicum* Pictet, an animal which is not only no Pachynolophus, but is not even a member of the Lophiodontidæ. Supposing its digits to be 4–3, it will enter the Menodontidæ, where I have placed it,[1] making it the type of the genus Acoëssus. How many of the species referred to Pachynolophus belong to Acoëssus I do not know, but in any case neither genus is a type of a separate family.

A further acquaintance with the American literature would have saved some minor errors. Thus it is stated that the limbs of Protohippus have not been described. They were described by me in 1873 (Annual Report U. S. Geolog. Survey Terr.), and were figured by Wortman in the *Revue Scientifique*, 1883, p. 712, from my blocks. The ancestral relation of Phenacodus to the Diplarthrous ungulate series, is ascribed to Wortman; but this view was published by the present writer long before that gentleman. The synonym Orotherium is ascribed to Cope instead of to Marsh. Merychippus is not different from Protohippus.—*E. D. Cope.*

Hayden Memorial Geological Fund.—Mrs. Emma W. Hayden has given in trust to the Academy of Natural Sciences of Philadelphia the sum of $2,500, to be known as the Hayden Memorial Geological Fund, in commemoration of her husband, the late Professor Ferdinand V. Hayden, LL.D. According to the terms of the trust, a bronze medal and the balance of the interest arising from the fund are to be awarded annually for the best publication, exploration, discovery or research in the sciences of geology and palæontology, or in such particular branches thereof as may be designated. The award and all matters connected therewith are to be determined by a committee to be selected in an appropriate manner by the Academy. The recognition is not to be confined to American naturalists.

[1] Classification of the Perissodactyla. Proceedings Amer. Philosophical Society, 1881.

GEOLOGICAL NEWS. — PERMIAN, TRIAS, ETC. — La Marmora, in his famous "Voyage in Sardinia," states that the Permian Triassic and even Liassic rocks seem to be entirely lacking in Sardinia. True Triassic beds, however, have been found in the southwest near Iglesias, while in the north of the island, near Nurra, Permian and Triassic strata occur. Descriptions of these rocks, with lists of their characteristic fossils, may be found in Bulletin XII. (2d series, vol. 11) and Bulletin XV. (2d series, vol. 5) of the *Comitato geologico d'Italia.*

JURASSIC. — The result of the researches of M. L. Dollo into the structure of the Iguanodontidæ is to prove that Iguanodon cannot be descended from Hypsilophodon or *vice versa*, but that they are the types of two utterly distinct families.

According to Dr. J. V. Deichmüller, the number of specimens from the lithographic slates now in the Dresden Museum reaches 1680, comprising 114 genera and 193 species, and including 48 species of fishes, 53 of insects, 48 of crustacea, and 21 of cephalopoda. Among the insects nine forms belong to the Orthoptera, seventeen, besides several still unidentified, to the Neuroptera, six to the Hemiptera, and eighteen to the Coleoptera. Of the Neuroptera two specimens only are *Neuroptera vera*, while the Termitina are represented by two, and the Ephemeridæ by one species. The remaining pseudo-neuropterous forms, comprising more than one-third of all the insect specimens, and nearly 95 per cent. of the neuropterous remains, belong to the Odonata. In his "Die Insecten aus dem lithographischen Schiefer im Dresdener Museum" (1886) Dr. Deichmüller not only gives fuller descriptions of previously known forms, but describes two new species of Locustidæ, one of Notonectidæ and one each of Carabidæ, Hydrophilidæ, Scarabæidæ, Buprestidæ, Elateridæ, Pyrrochroidæ, and Chrysomelidæ.

CÆNOZOIC. — M. L. Dollo, in his "Premiére note sur les Chéloniens oligocènes et néogenes de La Belgique," reviews the numerous remains of turtles belonging to the group Athecæ, of which Sphargis is the only existing representative, that has been found in the upper tertiary deposits of Belgium. Remains from the "Rupelian" clay (middle oligocene) were described by P. J. Van Beneden in 1883, under the title of *Sphargis rupeliensis*, while others from the "Bolderien" were by the same palæontologist named *Macrochelys scaldii*. The discovery of additional material has enabled M. Dollo to ascertain that the *Sphargis rupeliensis* of M. Van Beneden differs from the recent form by the presence of a continuous bony ventral armor, formed of a mosaic of small plates, while *S. coriacea* has only longitudinal series of isolated tubercles; by the slighter convexity of the carapace; by the

absence of projecting dentellated ridges upon the carapace; by the margin of the dorsal armor not being rolled downwards; by the greater thickness of the carapace; by the apparent presence of horny plates; and by a skull proportionately shorter, wider, and with thicker bones. The cretaceous genera of the group Athecæ, viz., Protostega and Protosphargis, were without a dorsal armor. M. L. Dollo concludes that all the fossil Athecæ yet found in the tertiary strata must be referred to the genus Psephophorus, and distinguishes four species: *P. polygonus* H. von Meyer; *P. pseudostracion* P. Gervais; *P. scaldii* P. J. Van Beneden; and *P. rupeliensis* P. J. Van Beneden.

From the careful researches of Prof. Scalabrini, supported by those of Dr. Doering and Ameghino, it is now thoroughly established that the sedimentary formations of the Argentine Republic present all the series of Tertiary strata from the eocene to the modern. The Patagonian formation includes three distinct horizons: the lowest eocene, of marine origin, is characterized by *Ostrea ferrarisi;* the middle corresponds to the lower oligocene, is of terrestrial or fresh-water origin and encloses bones of mammals, turtles, crocodiles, and fresh-water fishes; while the upper, of marine origin, characterized by *Ostrea patagonica*, represents the upper oligocene. The earlier conclusions of Darwin and D'Orbigny are thus confirmed, and Burmeister's later affirmations disproved. The remains referred to by Bravard to the Old World genera Anoplotherium and Palæotherium have been demonstrated by Ameghino to belong to two new genera peculiar to the New World, and are by him entitled Scalabrinitherium and Brachytherium, while a third genus near the former takes the name of Oxyodontherium.

M. Larrazet, as the result of his studies upon the character of the skin among fossil rays, divides them into three types: the first approximating to the modern Raja in form and size; the second, which has placoid ossifications with a broad base and small spine, forming the genus Dynatobatis; while the third, the dermal ossifications of which have a long spine and small base, forms the genus Acanthobatis.

Pliocene and Pleistocene. — M. A. Villott thus classifies the alluvial deposits of Dauphiné: (1) Those of the high plateaus, some of which occur at a height of 700 metres above sea level, and which may be referred to tertiary times; (2) The pre-glacial deposits of the lower plateaus, forming the upper part of the high terraces, and entirely belonging to the quaternary epoch; (3) The post-glacial alluvium of the lower terraces, formed after that great extension of the quaternary glaciers. The erosion of the valleys is referred principally to three different periods: (a) that which preceded the quaternary epoch, and was the result of the bursting of the pliocene lakes — a necessary result of the last elevation of the

Alps; (b) that which occurred during the glacial period; (c) that which is the work of the modern epoch.

Four years ago M. G. Rolland announced his belief that the great fresh-water formations of the Sahara are much less recent than had been hitherto believed, the greater portion of them belonging to the pliocene instead of the quaternary age. Subsequent studies of these deposits have confirmed his first opinion, of which he has now found palæontological proof by the discovery of a number of casts of species of Helix belonging to the group of *H. tissoti* and *semperina*, which characterize the lower pliocene of Biskra and Constantine. M. Rolland also shows the synchronism which exists between the different beds of the Eastern Sahara and the corresponding fresh-water beds of the pliocene and quaternary formations in the Atlas region.

MINERALOGY AND PETROGRAPHY.[1]

PETROGRAPHICAL NEWS.—Among the rocks gathered by Reyer[2] during a journey through the Sierra Nevada Mountains, Schuster[3] has found the following principal types: biotite granites, containing microcline and pilitized biotite; saussurite-diorite and quartz-diorite, containing orthoclase; saussurite, pilite, and biotite gabbros; quartz-porphyrites, kersantites, andesites, serpentine, fragmental rocks, and tufas. Although the paper in which these rocks are described consists merely of detailed descriptions of detached rock-specimens, it nevertheless contains many points of considerable interest. Pyrophyllite is mentioned as an alteration product of olivine and of plagioclase; reaction rims around augite and olivine are pictured; intergrowths of biotite and augite, of biotite and hornblende, and the alteration of biotite into pilite and into hornblende, are each described. Chromium mica is mentioned as occurring in a magnesite concretion in serpentine; helminth, as a constituent of a diabase porphyrite, and anorthoclase, as existing in a hornblende porphyrite. A most interesting case of intergrowth is that in which a long, tabular crystal of plagioclase penetrates diallage in such a way that its long edges are parallel to the orthopinacoid of the augite, and its twining lamellæ are parallel to the lines of inclusions in this mineral. Indications of the effects of pressure were seen in a large number of the sections examined.——Dr. Wadsworth[4] has recently published a report embracing preliminary descriptions of the peridotites, gabbros, diabases, and other rocks of

[1] Edited by Dr. W. S. Bayley, Colby University, Waterville, Me.
[2] Neues Jahrb. f. Minn., etc. Beil. Bd. v., p. 451.
[3] Ib., Beil. Bd. iv., p. 291.
[4] Geolog. and Nat. Hist. Survey of Minnesota, Bulletin No. 2. Minneapolis, 1887.

Minnesota. The report opens with a restatement of the author's views in regard to the classification of massive rocks[1] and a plea for the more careful discussion of the altered forms of rocks, with reference to the original forms from which they have been derived. The rocks described in this bulletin are typical specimens which have been collected from all over the northern portion of Minnesota by various members of the State Survey during the past few years. They are, therefore, not studied in their field relations to one another. The gabbros and diabases are the most widespread, and are regarded as very closely connected. Among the altered forms of gabbro are placed Irving's orthoclase gabbros[2] and most of his augite syenites, though some of the latter may possibly be altered forms of more acid rocks. Biotite as a secondary product, due to the reaction between magnetite and feldspar, and the same mineral, occurring as an alteration product of pyroxene, are described and figured. Norites, serpentines, hornblende-porphyrites, and many diabases are also briefly described. Lack of time and the impossibility of studying some of the most interesting of the rocks in their field relations prevented Dr. Wadsworth from elaborating many of the points which he has been able merely to indicate in his report.

The rocks comprising the three mountains in the Rhone region —known as Linsberg, Ulmenstein, and Pietzelstein—have been carefully investigated by Möller.[3] This author finds Linsberg to consist principally of a porphyritic rock composed of sanidine, andesine, augite, and nepheline, together with a few other minerals in small quantity. In the rock from near the top of the mountain the plagioclase predominates over sanidine, while in the specimens taken from its sides sanidine is more abundant. The former Möller calls tephrite, the latter phonolite. In the phonolite, corroded grains of hornblende are often surrounded by rims of augite. Associated with these rocks, but in smaller quantity, is a dark nepheline basanite containing corroded augite crystals surrounded by zones of the same mineral, with a similar optical orientation, but a little different composition. The main portion of the rock composing Ulmenstein is a nepheline basanite which, by the subordination of its feldspar, locally passes into limburgite. Some of the larger of the feldspar crystals in this rock show the hour-glass structure frequently seen in augite. The rock of Pietzelstein is a nepheline basalt. Very detailed analyses of specimens of all these rocks are given, and each is very minutely described.——According to Harker,[4] most of the dyke-rocks of the Island Anglesey, off the northwest coast of Wales, are diabases and augite porphyrites. One of these dykes cutting a calcareous shale has converted this rock into a lydianite, in which calcite, clusters of garnet, and anal-

[1] American Naturalist, 1885, p. 497.
[2] Copper-Bearing Rocks. Monog. V., U. S. Geol. Survey.
[3] Neues Jahrb. f. Minn., etc. 1888. I., p. 81.
[4] Geol. Magazine, 1887, Sept., p. 410, and Dec., p. 545.

cite crystals are developed. Other dykes from the northern portion of the island appear to consist of hornblende and biotite picrites. In one case newly formed, almost colorless hornblende is described as forming a cement between crystals of original hornblende, in a manner analogous to the quartz cement in indurated quartzites.

MINERALOGICAL NEWS.—The diamonds found in the Province of Minas Geraes, Brazil, are associated with the oxides of titanium, martite, monazite, and xenotine. They are usually found in quaternary alluvial deposits, but have their origin, according to Gorceix,[1] in the itacolumites and mica schists which are archæan. In these rocks they occur in deposits analogous to those of topaz, anatase, rutile, etc. All these minerals occupy well-defined bands in the itacolumite, and are original in it, and are not derived from some older rock, whose detritus supplied the material for the itacolumite and the mica schist. This explanation of the origin of Brazilian diamonds is quite different from that offered[2] in the case of diamonds of the African and American fields.——*Polianite*, the anhydrous manganese dioxide, has heretofore not been found in sufficiently well-crystallized specimens to admit of a satisfactory determination of its crystallographic constituents. The investigations[3] seemed to point to an orthorhombic symmetry for it. Messrs. Dana and Penfield[4] have recently proven it to be tetragonal and isomorphous with cassiterite, with $a : c = 1 : .66467$. The crystals examined are composite, being composed of several tetragonal individuals which produce a body with an orthorhombic habit. Their specific gravity is 4.992, and their composition as follows:—

MnO	O	Fe_2O_3	SiO_2	H_2O	Insoluble.
80.81	18.16	.16	.36	.28	.16,

revealing a very pure manganese dioxide.——In the basalt from the neighborhood of Périer (Puy de Dôme) are little veins of clayey material[5] in which are imbedded crystals of augite and lozenge-shaped flat plates of *feldspar*. The plates are sections parallel to the clinopinacoid, bounded by the planes oP and $P\bar{\infty}$ equally developed. They are frequently twinned with $\infty P\bar{\infty}$ as the composition face.——Jannetaz[6] has analyzed *uranite* from the Island of Madagascar, with this result:—

——Igelström[7] has discovered a manganese, rich and antimony-

P_2O_5	NO_2	Fe_2O_3	CaO	Loss (water).
14.93	55.08	1.365	6.51	22.08

[1] Comptes Rendus, cv., 1887, p. 1139.
[2] American Naturalist, 1887, p. 664.
[3] American Naturalist, March, 1888, p. 249.
[4] Amer. Jour. Sci., March 1888, p. 243.
[5] Lévy: Bull. d. l. Soc. Franç. d. Miner., X., 1887, p. 69.
[6] Ib., p. 47.
[7] Bull. Soc. Franç. d. Min., ix., 1887, p. 218.

bearing *berzellite*, associated with barite, tephroite, calcite, and hausmannite, in veins and nests in the vicinity of Sjögrufan, Grythyttan parish, Örebro, Sweden. The new mineral, to which the name *pyrrhoarsenite* has been given, has a color resembling that of crocoite. It has a hardness of 4, and is soluble in hydrochloric acid. It possesses the optical properties of berzellite, and a composition as follows:—

$As_2O_5+Sb_2O_5$	MnO	CaO	MgO	SiO_2	H_2O	$Al_2O_3+Fe_2O_3$
58.06	17.96	18.68	3.58	1.02	.85	traces.

which may be represented by the formula $(Ca,Mn.,Mg)_3(As, Sb)_2O_8$.

Miscellaneous.—Cohen[1] has re-investigated the subject of the pleochroic halos (Höfe) in the biotites of granite and gneiss, and is thereby led to the conclusion that they are produced by the accumulation of organic substances in the neighborhood of the inclusions they surround, and are not due to the aggregation of mica molecules richer in iron than those forming the main portion of the mineral in which the halos occur. He finds, contrary to the experience of Lévy,[2] that the halos are not affected by treatment with hydrochloric acid, as they should be if they contain a large proportion of iron, but that they are destroyed by heating to a temperature considerably higher than that which is necessary to obliterate the halos in muscovite and cordierite, in which minerals this phenomena is now generally believed to be due in some way to an organic substance.——Franklinite, together with its natural associate, zincite, has been artificially produced by Gorgeu[3] by subjecting to a cherry-red heat an intimate mixture of one part of sodium sulphate, one-half part of zinc sulphate, a quarter to a half part of ferric sulphate, and a little manganese sulphate.[4]

BOTANY.[5]

The Collection and Study of Characeæ.—Characeæ are neglected by botanists in general, who seem to have an aversion to all aquatic plants, mainly, it is presumed, from the fact that the collection of aquatics is a specialty. One must go prepared with dredge and rake, with paper and muslin, in order to gather successfully plants of this sort. It has come about that very few bits of Characeæ have been gathered here and there by expeditions and by

[1] Neues Jahrb. f. Min., etc. 1888. I., p. 165.
[2] Comptes Rendus, xciv., 1882, p. 1196.
[3] Bull. Soc. Franç. d. Min., x., 1887, p. 50.
[4] Cf. American Naturalist, 1887, p. 475.
[5] Edited by Prof. Chas. E. Bessey, Lincoln, Neb.

individuals in America up to recent years; but it is evident that these plants abound in our waters, and that our Chara-flora is varied and strongly characterized. Probably not one-half of the American species have as yet been brought to light, but it is confidently anticipated that a better knowledge of their structure and classification will result in a more widespread interest in them.

These plants, often delicate or brittle from an incrustation of lime, are easily destroyed by waves, so that they are rarely found on exposed shores, unless in water deep enough to be beyond the reach of the surface movements. They flourish best in sheltered bays and smaller ponds, especially if a tolerably uniform level of water be maintained. Great changes of level are destructive, alike to species that love the sun and grow in shallow water, and those that hide away in the depths. It is rare, therefore, that Chara-hunting is profitable in ponds or lakes which feed canals or factories. One prefers the land-locked sheets of water fed by springs, especially if there be a sandy bottom. Temperature has but little influence upon them, though the South has its distinctive species, as well as the North. One species, at least, *Chara fragilis*, is universal, found in every country and clime, in ice water at the North, and in the hot springs of the Yellowstone, "hot enough to cook an egg in four minutes."

The best condition of the plant for examination is when it has mature fruit. The time at which this occurs is usually late summer or early fall, though a few species mature early in the spring, and die off in summer. At the South the species are often in good condition the year round, the old fruit holding on, even after new shoots have started from the old nodes.

To gather Characeæ successfully a dredge must be used; for shallow water a small fine-toothed rake is preferred, but for deeper water (one rarely finds them at a greater depth than ten feet) the dredge and line are essential. The best dredge for all purposes is the one recommended by Professor Nordstedt, made as follows: — A disk of lead about three inches in diameter and three-fourths of an inch thick has imbedded in its circumference a row of hooks, about ten in number; through the centre of this disk is passed an iron rod, which projects about three inches below the disk and about nine inches above; to the ring in the upper end toward which the points of the hooks are directed a cord is attached. The dredge weighs about two and a half pounds, and catches all sorts of "weeds" growing on the bottom.

The dissection of these plants is perfectly simple. The delicate species are placed in water until their normal form is restored (if they have been dried), and a portion is put in a "cell" on a glass slide and examined under a two-inch objective; sometimes, but rarely, a higher power is needed for determining fine points, such as the structure of the cortex.

Should the species be incrusted with lime, a piece should be

placed in a little strong vinegar till the lime is completely dissolved, then washed in pure water and examined.

Specimens foul with mud must be cleaned in water with a camel's hair brush, but this is liable to detach the globules of fruit, and is only occasionally to be resorted to. Should it be desirable to preserve bits for future reference, they are best mounted in glycerine-jelly, in "cells" deep enough to avoid crushing and shallow enough to permit free examination (flattened brass curtain-rings make excellent cells). When the jelly has dried at the edges, turn on a ring of white zinc cement. — *T. F. Allen, in "The Characeæ of America."*

The Fibre of the Banana. — In a report by the United States Consul, L. J. Du Pré, at San Salvador, Central America, the following statement possessing botanical as well as commercial interest occurs: —

"Inquiries made by manufacturers of coffee sacks, and by rope, cordage and paper makers addressed to the consulate are answered by the statement that each banana tree is two and a half to three feet in circumference at its base. Its tapering fibrous body, without a branch, is from ten to fifteen feet in height. These fibres, separated by a thin pith, are of the length of the body of the tree, in which there are no joints. These fibres are used here just as they are taken from the tree and dried, as shoe-strings and as cords for all purposes. The several threads constituting them are of silken fineness, and infinitely separable. The natives use them in making 'bridle-reins' and lariats for most recalcitrant mules. The raw material costs only transportation to the rope-walk. Each banana tree bears in the twelve months of its existence only one bunch of fruit, but from two to four or ten trees spring from the roots of the one that has fallen. The bunch of bananas is worth here fifteen cents, and the dead tree nothing. A cordage factory, or paper mill, or coffee-sack maker, were not the defunct banana trees numberless, would give for each dead tree ten times the value of the fruit it produced. Split, dried and packed, the bodies of the banana trees might be shipped profitably to the United States. * * *

"The stem of each banana leaf consists of the toughest and finest threads, and these leaves two and a half to three feet wide, and ten to fifteen feet long, resting on the heads of the native women, are umbrellas in the rainy season in the roofless market places and streets of Salvador. They are the carpets on which they sit, and the beds on which they repose."

Gray's Contributions to American Botany. — It is with melancholy interest that we note this last incomplete contribution, the final one of a long series, which appeared in the Proceedings of the American Academy of Arts and Sciences. This was presented

by Dr. Sereno Watson, on March 14, 1888, more than a month after the lamented author's death, and is entitled "Notes upon some Polypetalous Genera and Orders." Certain doubtful Rutaceæ are discussed, among them *Xanthoxylum*, to which correct orthography the author calls particular attention.

The notes on Vitaceæ, by way of review of Planchon's "Ampelideæ," he had scarcely commenced "when his work upon the Flora of North America ceased." He pointed out, however, that if we accept Planchon's numerous genera (see AM. NAT. for March), we must take up Rafinesque's name, *Quinaria*, instead of *Parthenocissus* for the Virginia Creeper and its relations. Dr. Gray, however, pronounced emphatically against the innovation, maintaining that "the *Ampelopsis quinquefolia* Michx., remains as the proper representative of the genus, and should preserve the name." Further he says: "It may still be questioned whether the mass of Ampelideæ can be definitely separated from Vitis, and into how many genera divided; but surely *Ampelopsis*, with the Virginia Creeper as the type, must be admitted as a good genus."

A NEW TYPE OF LICHENS. — Formerly it was supposed that all lichens were ascomycetous, and it was quite a shock when a few years ago the announcement was made of the discovery of certain hymenomycetous lichens. We are now told by Massee (Arch. Sci. Phys. and Nat., xviii.,) of a couple of genera of gastromycetous lichens. Thus we have now known the following groups of lichens: (1) Ascolichenes, (2) Hymenolichenes, and (3) Gastrolichenes.

THE ASH OF TILLANDSIA USNEOIDES.—This plant, popularly known as the Florida long-moss, is considered as a typical epiphyte. Reliable observers have stated that it will grow and increase, month by month, on a support as juiceless as a telegraph wire. Its roots are looked upon as mere hold-fasts—anchors, to prevent the plant from falling to the earth. No absorption is supposed to take place through those roots; thus the plant is considered to differ from parasitic species like Phoradendron, etc. Yet it is well known that this so-called epiphyte has a certain proportion of mineral matter in its make-up. At the suggestion of Professor Henry Trimble, I have made an analysis of this ash, and have found the composition of it to be full of interest. If the roots do not absorb the juices of the supporting trees, then this mineral matter found in the plant must be collected from the air. It is hardly to be supposed that the floating dust of the forests where the *Tillandsia* grows is very abundant; and it seems almost absurd to think that all the elements found in the ash can have been collected in this way. The following are the results obtained from about 100 grammes of the dried plant. The moss was in a green condition when received. *Total ash*, 2.95 per cent. Composition:—

Silica	10.300 per cent.
Ferric oxide	2.100 per cent.
Alumina	2.600 per cent.
Oxide of manganese	1.672 per cent.
Lime	12.700 per cent.
Magnesia	11.351 per cent.
Potassa	13.759 per cent.
Soda	14.856 per cent.
Sulphuric acid	7.419 per cent.
Chlorine	6.947 per cent.
Carbonic acid	12.900 per cent.
Phosphoric acid	3.034 per cent.
	99.638

But one other analysis of this ash has been found by me; that of Avequin,[1] in 1835, which is recorded in the following way (in effect, as I have not the exact language at hand):—

1,000 grammes of dry plant gave 32.35 grammes of ash, composed of—

Salts of potash (phosphate, sulphate, carbonate and chloride)	11.47 gr.
Lime (partly as carbonate)	5.96 gr.
Phosphates of lime and magnesia	9.26 gr.
Silica containing a little iron and manganese	5.66 gr.
	32.35

It will be observed that the total ash (3.235 per cent.) is nearly the same as that obtained by me. If the iron and *alumina*, as well as the manganese, in my analysis, are added to the silica, the sum is 16.672 per cent., which is not greatly different from the impure silica of Avequin, 17.186 per cent. It would therefore appear that the plant must uniformly have some such ash as that found above. (Indeed, the ash of any one plant, as is well known does not vary greatly.) What, then, shall we think? That the roots do absorb the characteristic ash-constituents from the trees on which they grow? That would seem to me more rational than to suppose them to be absorbed from the floating matter of the air. But if we do arrive at this conclusion, our idea of the term epiphyte must certainly undergo a radical change.—*T. Chalkley Palmer.*

The Effect on Vegetation of the Variable Rainfall of Northwestern Mexico.[2]—First, want of water. Those who have travelled over the northwestern portion of Mexico will, I think, agree with the writer that it is a dry, barren section, and in want of water. Rains are very uncertain, often years passing without a shower sufficient to cause a good growth of vegetation. When the first white settlers made their homes in this region, over two hundred years ago, they did so during a very dry period of several months, during which they formed the conclusion that the

[1] Journal de Pharm. et Chimie [3], xxxv., 95.

[2] Read before the Botanical section of the Biological Society of Washington, March 7, 1888.

region was one in which it never rained. Their effort, therefore, was to do without rain. The settlements were made near springs or streams, both of which were few, and consequently the settlements limited. During the thirty-two months previous to last August enough rain had not fallen to produce vegetation of sufficient length to be cut for hay. The appearance of the country during the dry season is that of a waste, destitute of food for man or beast, except in favored spots along the creeks and springs; and if nature did not endow some of the plants with power to bloom and mature their fruits during different periods of the year, this desert country would be still more uninviting. The various numbers of the Cactus family produce their showy and attractive flowers during the dry season, these being followed by the sweet, juicy and nutritious fruit, during the hottest part of the year, about the last of June.

There are some forms of the Leguminosræ which also bloom and mature fruit during the dry period when there are no leaves upon them. These plants which bloom and fruit during the dry season, though but a small portion of the whole, contrast very agreeably with the pinched, withered, and resting plants that surround them.

What adds still more to the desert appearance of the country at this season of the year is the character of the soil; the hills and mountains, which are very rocky, have now put on their sombrest, reddish brown, and not a vestige of green is observed upon their surface.

A stranger coming into the country during the dry season would ask the question, "When or how often does it rain?" A botanist desiring to make a collection can only gather the plants that bloom during the dry season, and must wait for the rain in order to complete his collection. One serious effect of the insufficient rains is seen when the shrubs and annuals start into growth after a shower, only to be killed or fail of maturity during the subsequent drought.

The second cause of the scanty vegetation of this region is excess of water. The violent rains and water-spouts which occasionally occur are exceedingly destructive.

In 1717 there was a great rainfall, and those people who had come to the belief that it never rained there, and had only provided themselves with the cheapest and easiest contrivances in which to live, found that it did rain — for forty-six hours it rained so excessively that it destroyed nearly all the food the inhabitants had. The churches and other buildings of the missionaries were leveled to the ground, they being of unburnt brick, while the fields that had been planted, or prepared for planting, were denuded of every plant — natural or cultivated. The rains left in place of the soil so thick a coating of sand and stones that the fields had for the most part to be abandoned and new ones prepared.

Not far from Guaymas is a small village, celebrated for its gardens. A few years ago this place was devastated by heavy rains; many houses were carried away, some gardens greatly injured and others entirely obliterated. Where once there were gardens is now a large area covered with rocks, gravel and sand, resembling a dry river bed. The inhabitants point out to you many localities once fertile, now barren in consequence of excessive rains. Last summer a waterspout fell in the village of Molage in Lower California. The village is built on the brow of a range of low rocky hills, in front of which runs a small stream used to water the gardens upon either side. So sudden and great was the fall of water that before the inhabitants were aware of it the flood was upon them and many houses swept away, the people having barely time to escape with their lives. After the waters had subsided, the valley which had been filled with gardens and green fields presented a rocky waste, as barren as the adjoining hills upon which no rain had this year fallen. While travelling in this part of Mexico last autumn my attention was frequently called to spots injured by the fall of waterspouts. In a country with so little land suitable for cultivation, the loss of however little is severely felt by the inhabitants.

The period which is considered the rainy season lasts from July to December. In one place the rains may commence in one month, in another place some other month, and no two places, however near, are likely to have the same amount. For example, about Guaymas last season the rainy season commenced in the middle of August and ended about the first of October, during which four good rains fell, while at Angel's Bay in Lower California, the first rains were a shower in the early part of November and another about the first of December. After this vegetation quickly sprang up and into bloom, so that at the time of my visit the place looked like spring, while at the same period the vegetation about Guaymas, only two hundred miles distant, had come to maturity. — *Dr. Edward Palmer.*

ZOOLOGY.

KIDNEY IN SEA-URCHINS.—The brothers Sarasin (*Zool. Anzeiger*, 227) claim that the brown structure which surrounds the stone canal of the sea urchins, and to which numberless functions have been ascribed, is in reality a nephridial apparatus. In Asthenosoma this organ rests below on the circumoral blood and water rings, and throughout its extent it forms a large hollow tube. From this cavity are given off numerous large glandular folds, composed of cells which resemble those of renal organs, and notably those of the

Molluscs. These glandular pouches empty into the main lumen by narrow ducts, while delicate canals, following a contorted course, extend to the periphery of the organ and terminate by ciliated funnels in the body cavity in a manner which recalls the nephrostomes of segmented animals. The excretory duct runs towards the aboral surface, and beneath the stone canal forms a narrow duct, both stone canal and ureter uniting in a common collecting vesicle which empties through the madreporic canals.

Life History of Hair-Worms.—In a recent paper on the hair worms L. Camerano discusses several points in connection with these forms. He thinks that the same species may occur in different hosts, the filiform condition being found only in insects. Man may be occasionally a host for some of the larval stages. The cycle of the individual is as follows: The eggs, which are laid freely in the water, hatch out larvæ which swim freely and then obtain entrance to a host when they become encysted and undergo a metamorphosis. The metamorphosis results in the young, filiform larvæ which grows directly into the adult, with sexual organs developed. This lives freely in the water where copulation takes place and the eggs are laid. Some strictures upon the account given by Camerano may be found in the *Zoologisches Anzeiger* for 1888, p. 70. Villot there states that some of Camerano's species are in reality immature forms.

The Origin of Segmental Organs.—M. F. E. Beddard (*Q. J. M. S.*, 1888) discusses the structure of the nephridia in Acanthodrilus and Perichæta. In each of these genera there are several segmental organs to each segment, there being in Acanthodrilus over a hundred apertures in a segment. The glandular part of the system varies much from the typical condition of nephridia in other respects. In Acanthodrilus the inner openings of the tuft-like nephridia were not found, while the excretory ducts of the eight or more organs in each segment were branched, each branch communicating with a nephridiopore. In Perichæta the case is even more complicated. The tubules were not observed to branch in the body wall, but in the body cavity the nephridial system forms a continuous network passing through the dissepiments from one segment to another, while the systems of the right and left side of the body also communicate with each other. Internal funnels were not found. Beddard reviews the opinions advanced by various naturalists as to the phylogeny of the nephridial system of the annelids and thinks that the new facts which he adduces favor the view that the annelid excretory system is directly traceable to that of the Plathelminthes. He, however, differs from Lang in his theory in that he does not regard the longitudinal duct of many annelids as in any way homologous with that of the Plathelminthes, but, in the light of Wilson's researches, as an entirely different structure.

Branchial Eyes of Branchiomma.—Branchiomma is a genus of Sabillid worms remarkable for possessing eyes on the tips of its gills. C. Brunotte (*Comptes Rendus*, 1888, p. 301) has recently described the structure of these, arriving at the following conclusions. They are to be regarded as a new type of compound eye formed of two layers, an outer dioptric and an inner sensory. The outer surface is facetted and beneath each facet is found a small spherical lens situated above a rounded cavity which is filled with a large nucleated cell, and behind this is an elongated refractive body connected with terminations of the optic nerve. This part of the eye is without pigment.

Phosphorescent Organs of Thysanopoda.—R. Vallentin and J. T. Cunningham discuss the structure and functions of the phosphorescent organs of *Thysanopoda* (*Nyctiphanes*) *norvegica* in the February number of the *Quart. Jour. Micros. Science.* These crustacea have long been known to have eye-like organs upon the sides of the body and in the median line,—organs which were universally regarded as accessory eyes until the present decade. There are ten of these organs, their distribution being pretty uniform in all the genera of the family Euphausidæ to which Thysanopoda belongs. All of these organs except those on the peduncles of the eyes have the same structure. Behind the organ is bounded by a layer of wavy laminæ forming a hemispherical unperforated cup open in front. This is compared to the reflector described by von Lendenfeld in Fishes (*vide Amer. Nat.* xxii.). This reflector is lined internally with red mesodermic pigment-cells, and their interior are lined by a layer of large columnar cells, inside of which is a curious fibrillar structure which surrounds the inner half of the biconvex lens. Outside the lens occur a circular cornea followed by the ordinary epidermis and the usual cuticle. All of the cellular layers outside of the pigment zone are ectodermal. The organ in the ocular peduncle differs in the absence of lens and cornea. Some notes occur on the development of these organs.

The observations on the function of these organs are more interesting. In life the animals are incessantly active and in the dark give out, occasionally, short flashes of light. When touched with the hand a flash immediately followed, while handling caused all the organs to shine for five or ten seconds. Continuation of the handling caused an almost unlimited succession of flashes until the animal was exhausted. The stronger the pinch, the longer and more brilliant was the light. If crushed and rubbed between the fingers certain particles were luminous and remained so until dry. Chemical stimulation with corrosive sublimate and nitric acid also produced activity of the organs. Careful microscopical study showed that in the light the inner surface of the reflector possessed fluorescent qualities, while when crushed in the dark this same layer emitted an intrinsic light. A comparative review of phosphorescent organs in other animals concludes the paper.

Reproduction of Lost Parts in the Lobster.—Mr. George Brook (*Proc. Roy. Phys. Socy. Edinb.*, ix.) after a historical résumé of the results of others, details the results of his own observations on the reproduction of lost legs and antennæ in three lobsters which he kept in confinement. He concludes that in the lobster at least—contrary to Reaumur—the new appendage, which is formed beneath a thin pellicle soon after the loss, is only set free at the time of molting. The antennal rudiment is at first conical, then becomes coiled in a spiral, and at the first molt this is set free, but the normal size is not reached until three or four molts. The large claws also required a similar period, becoming as large as their fellow. In one instance the right claw was lost when the pincer of the left side was three inches long. At the next molt the new right pincer was $2\frac{3}{8}$ inches long, while its fellow had increased to $3\frac{3}{8}$ inches; at the second molt the difference between them was reduced to $\frac{1}{2}$ inch, while the third molt reduced the disparity to $\frac{1}{4}$ inch. The ambulatory limbs, on the contrary, regain their full size in a single molt, an observation at variance with Chantran's account of the reproduction of lost parts in Astacus.

The Ossicula Auditus of the Batrachia.—The following is an abstract of a paper read before the United States National Academy of Sciences at its meeting in Washington on April 18th, 1888. The conclusions reached are the following:

First.—The relations of the stapes to the quadrate cartilage or bone in tailed batrachians are of two types; in the one the stapes is connected with the quadrate; in the other it is not. The former arrangement is possessed by the Proteida, Trematodera, Amphiumoidea and Pseudophidia (*Cæciliidæ*); the other by the Pseudosauria (*Myctodera*) and Trachystomata. The larval structure in the Pseudosauria, and inferentially in the Trachystomata, is identical with the structure characterizing the adults of the other division. This is confirmatory of the opinion which I have expressed [1] as to the origin of the genus Siren. This is to the effect that Siren is an animal which is descended from a land salamander, and its immediate ancestor became aquatic again at a comparatively late period of geological time. My opinion was at first suggested by the condition of the branchiæ in very young animals, where they are functionally abortive, and do not become respiratory organs until later in life, the largest animals having the best developed gills. The characters of the stapes confirm this view, since they are those of land salamanders, as distinguished from those of aquatic habitat.

Secondly.—There are three types of relation between the ceratohyal arch and the skull. In the one there is no connection between the two, as in the Pseudophidia. Secondly the connection is ligamentous. This is seen in Proteida, Trachystomata, and all Pseudosauria except the Amblystomidæ and Plethodontidæ. The last two

[1] American Naturalist, 1885, p. 1226.

families embrace the third type, in which the ceratohyal is articulated by suture with the quadrate. This last type is the most specialized, since the larvæ of those families display the connection between the ceratohyal and the skull similar to that seen in the type second. Thus the Salamandridæ, which are superior to the Plethodontidæ in their osseus carpus and tarsus and opisthocœlous vertebræ, have the hyoid connected with the skull as in the larvæ of the latter.

Third.—At a stage in the history of the development of the Salientia, the relations of the stapes and of the ceratohyal to the skull are the same as in a transitional stage of the Urodele family of Plethodontidæ. Or taken separately, the relations of the stapes are those of Proteida, Trematodera, and larval Pseudosauria, while the relation of the ceratohyal is as in adult Plethodontidæ and Amblystomidæ. This is when the interstapedial cartilage connects the stapes with the posterior face of the quadrate cartilage, and when the ceratohyal articulates with the posterior face of the quadrate at its distal part.

Fourth.—It is not probable that the epistapedial forms an integral part of a primitive element representing the ossicula auditus, as it originates independently of the interstapedial and mesostapedial.

Fifth.—The interstapedial and mesostapedial do not at any time in the history of the development of the genus Rana form any part of the ceratohyal or Meckelian ventral arches. As the incus and malleus of the mammalian ossicula auditus are segmented from the proximal parts of these arches, embryology indicates that they are not homologous with the ossicula of the Salientia. From this point of view the latter form a special line of development, distinct from that displayed by the Mammalia, unless the developmental record has been greatly falsified by cænogeny. From the embryological standpoint it follows that the ossicula auditus of the Batrachia Salientia must be excluded from the discussion of the homologies of the mammalian ossicula.

Sixth.—But the characters of the Ganocephala and Rhachitomi permit the following reflections, since the latter order is the one from which the Salientia derived their descent. The existence of a well-developed columella auris which is unsegmented, in the former orders, apparently like that of the Lacertilia, suggest that the segmentation seen in the Salientia is a specialization of later origin. This columella has also the position of the proximal part of the ceratohyal in the adult frog and the larval salamander. As the position of this element in all but the youngest tadpoles is a result of cænogeny, it may be inferred that the ossicula auditus of both the Rhachitomi and the Salientia represent the separated proximal end of that arch, and hence be truly homologous with the incus of the mammal. The probability that this is the case is increased by the character of this element in the Pelycosaurian genus Clepsydrops[1] where the columella extends to the cranial wall, leaving

[1] See Proceed. Amer. Philosoph. Society, 1884, p. 41, Pl.

the stapes to one side. This is exactly comparable to the relation between the interstapedial and the stapes seen in the Salientia, except that the two elements are not actually connected as in Clepsydrops. Palæontology then modifies the evidence from embryology, and renders it highly probable that the columella auris, interstapedial and incus are homologous elements, and originated by segmentation from the proximal end of a ventral cranial arch, probably the ceratohyal.

Seventh.—It follows, from what has preceded, that the condition of the representatives of the *ossicula auditus* in the Urodela is one of degeneration.

Eighth.—It becomes probable, but not certain, from the position of the tympanic disc in the Rhachitomi at the proximal base of the quadrate bone, that the epistapedial cartilage has originated as a segmentation from the proximal extremity of the quadrate cartilage, and is therefore truly homologous with the mammalian malleus. This is, however, nothing more than a possibility.—*E. D. Cope.*

EXPLANATION OF PLATE.—AURICULAR AND SUSPENSORIAL ELEMENTS OF BATRACHIA.

Fig. 1. *Trimerorhachis insignis* Cope, from below; $\frac{3}{4}$ natural size.

Fig. 2. *Zatrachys serratus* Cope, corresponding part of the skull to Fig. 1; opposite side from above; $\frac{3}{4}$ natural size.

Fig. 3. *Cryptobranchus allegheniensis* Daud.; × 2; middle part of squamosal bone removed.

Fig. 4. *Diemyctylus viridescens* Raf.; × 8; squamosal bone removed and represented at 2 a; 2 b, end of ceratohyal, showing connection with hyoquadrate ligament.

Fig. 5. *Typhlonectes compressicauda* D. and B.; from the Belize; × 3.

Fig. 9. *Amblystoma tigrinum* Green, larva; × 4; squamosal bone removed and represented (under side) at *Sq.*

Fig. 12. *Rana virescens* Kalm, larva; × 4.

Fig. 13. *Rana catesbeiana* Shaw; larva more advanced than Fig. 12; × 3.

Fig. 14. *Plethodon glutinosus* Green; × 6; squamosal bone removed and represented at *Sq.*

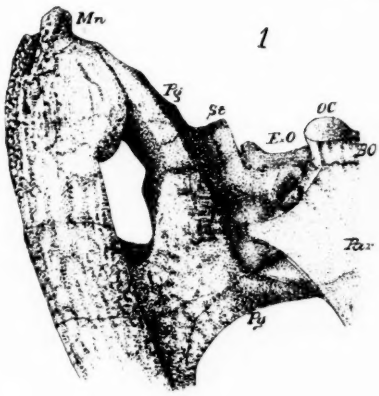
Fig. 15. *Siren lacertina* L.; × $\frac{1}{2}$.

Fig. 16. *Rana pretiosa* Bd. Gird.; × 2; auricular bones removed at *a*, the distal elements in section.

Explanation of Lettering.

A. T., Annulus tympanicus; B. O., basioccipital; C. Br., Ceratobranchial; C. H., Ceratohyal; C. Tr., Cornu trabeculi; E. S., Epistapedial; Eth., Ethmoid; Ex. O., Exoccipital; F. P., Frontoparietal; Hm., Hyomandibular; H. Q., Hyoquadrate ligament; I.

PLATE VI.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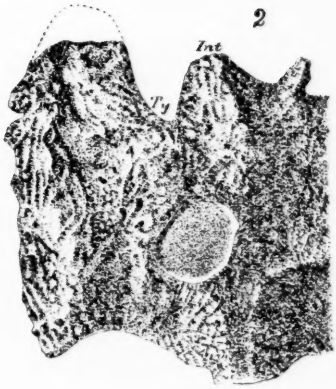
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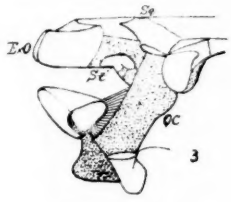
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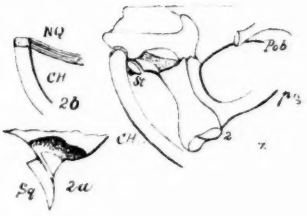
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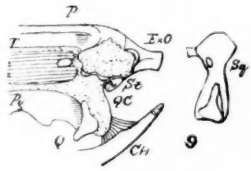
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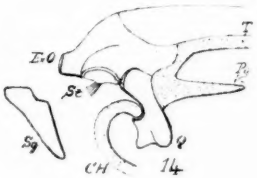
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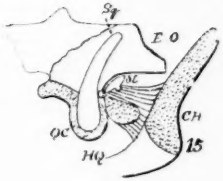
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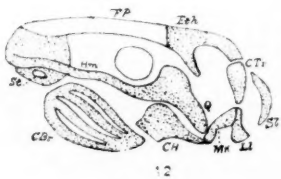
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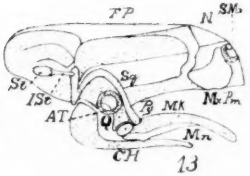
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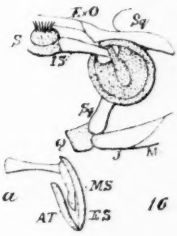
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St., Interstapedial; J., Jugal; Ll., Lower labial cartilage; Mk., Meckel's cartilage; Mx., Maxillary; Mn., Mandible; M. S., Mesostapedial; O. C., Occipital condyle; P., Parietal; Par., Parasphenoid; Pg., Pterygoid; Pm., Premaxillary; Q., Quadrate; Q. C., Quadrate cartilage; S. St., Stapes; Sq., Squamosal; Sl. Superior labial cartilage; T., Trabeculum. Cartilage, dotted; ligament and membrane, lined; bone, blank.

Systematic Position of the Monitors.—F. E. Beddard (*Anat. Anzeiger*, 1888) points out that the Monitoridæ are in several features widely separated from the other Lacertilia, and that the same peculiarities tend to ally them to the Crocodiles. Among the points discovered by other naturalists he mentions the arrangement and development of the teeth, the complicated network formed by the hepatic and cystic ducts, and the arrangement of the blood vessels of the neck. The new features are: On cutting through the abdominal wall the viscera are not at once brought into view, as they are enveloped by a fold of the peritoneum which forms a closed sac completely separating the abdominal viscera from the heart and lungs. This feature is compared to a similar structure described by all students of crocodilian anatomy. Huxley compares this last with the oblique septum of the bird, but Beddard thinks it equivalent to the septum and to the so-called omentum as well and at the same time but an exaggeration of the structure occurring in the Monitors. If his points are well made (that the Monitors are not closely allied to the other Lacertilia but rather to the Crocodilia) Beddard thinks that the ancestry of the Crocodiles must be sought in the direction of the Monitoridæ.

A Cow With One Kidney.—I lately saw butchered a healthy cow which had but one kidney, the right one. It was double the usual size and weight; length 11 inches, width 43 inches, weight 2¼lbs., thickness 2 inches. The ureter was present on the left side. —*Henry Shimer, M.D., Mount Carroll, Ill.*

ENTOMOLOGY.[1]

A LABORATORY OF EXPERIMENTAL ENTOMOLOGY.—Reference has already been made in these Notes (*Ante*, p. 261) to a probable increase in entomological investigations, due to the establishment by the United States Government of an agricultural experiment station in each of the States, in connection with the agricultural colleges. The New York Station has been organized at Cornell University. Provision has been made here for experiments in general agriculture, chemistry, veterinary science, botany, entomology, and horticulture. The Station Council has been very liberal in its provisions for experiments in entomology. A separate building for this purpose is being erected, and provision has been made for thoroughly equipping it.

As this building is novel, both as regards its structure and the purpose for which it is intended, a brief account of it may be of interest. It consists of two parts—a laboratory building and a vivary. The former is a two-story cottage, containing a laboratory for the experimenter and his artist, a shop and laboratory for an assistant, a room for photographic work, quarters for a janitor, store-room and basement. The vivary is in the form of an ordinary botanical conservatory, sixty feet in length. This is divided by a transverse partition into two rooms of equal size. One of these is to be used as a hot-house; the other is to be kept as nearly as possible at the temperature of the outside air. The purpose of this vivary is to enable the experimenter to keep the insects that he is studying alive upon growing plants and to conduct experiments with insecticides, where all of the conditions can be controlled. Especial apparatus for carrying on this work has been devised and is being constructed.

One of these devices is an arrangement by means of which insects living upon roots of plants can be observed continuously without disturbing them. Another is intended to aid in the study of the relations that exist between ants and plant-lice. Others are for experiments in the use of insecticides. Descriptions of some of these devices will be published later.—*J. H. Comstock.*

AQUATIC LEPIDOPTEROUS LARVÆ.—A number of instances are on record of Lepidopterous larvæ that normally descend beneath the surface of water in order to feed upon submerged plants. The best-known of these in this country is the species of *Argama* that infest the leaf-stalks of pond-lilies. The habits of this insect were described by the writer several years ago.[2] Although these insects

[1] This department is edited by Prof. J. H. Comstock, Cornell University, Ithaca, N. Y., to whom communications, books for notice, etc., should be sent.

[2] Papilio. Vol. I., p. 147.

spend a large part of the time in water, they are obliged to come to the surface at intervals for a supply of fresh air. There are, however, a few Lepidopterous larvæ that are truly aquatic. One was described by Baron de Geer more than one hundred years ago.[1] This is the European *Paraponyx stratiotalis*. Another was described in 1884 by Wilh. Müller-Blumenau.[2] This is a Brazilian insect, *Cataclysta pyropalis*, which, like the preceding, belongs to the family Pyralidæ.

We have just received an account of a third species, which is described by J. Wood-Mason in a small pamphlet, entitled *Report on the Paraponyx oryzalis, an Insect-pest of the Rice-Plant in Burma*. This pamphlet was published in Calcutta in 1885. The insect described in it is supposed to be a congener of the European species referred to above, although only the larva and pupa have been described. The caterpillar is about seven millimetres in length and is abundantly supplied with tracheal gills. These are in the form of filaments, arranged in little bundles or tufts. There are four longitudinal rows of these tufts, extending nearly from one end of the body to the other; that is, two rows on each side of the body—one above the spiracles, the other below them.

THE ORTHOPTERA OF NEW ENGLAND.—Professor Fernald has just published a manual of the Orthoptera of New England,[3] in which all the species found in that section are carefully described. Analytical keys are given for the determination of families, subfamilies, and genera, and, wherever necessary, there are tables of species. The work is an important addition to the series of handbooks prepared by this author. It will do much towards popularizing a knowledge of this very important order of insects.

PROCEEDINGS OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON.—Among the recently published works on our table is No. 2, of Vol. I., of the above-named publication. This number includes the proceedings of this Society during the years 1886 and 1887. It contains a large number of biological and morphological notes, some of them of great interest. The most important of these is the annual address of the President, Mr. L. O. Howard, entitled *A Brief Consideration of Certain Points in the Morphology of the Family Chalcididæ*. The address is much more important than would be indicated by its title, being, in fact, a careful discussion of the external anatomy of these insects.

[1] Memoires pour servir à l'Hist. des Insectes, 1752, Vol. I., pp. 517–541. pl. xxxvii.

[2] Arch. f. Naturgeschichte, Band I., pp. 194–211, pl. xiv.

[3] From the Twenty-fifth Annual Report of the Mass. Agri. College, 1888.

EMBRYOLOGY.[1]

Embryology of Insects and Arachnids.[2]—Under this title, the friends of the author have issued the results of studies made by the late Dr. Adam Todd Bruce upon the embryology of Thyridopteryx, Chrysopa, Meloe, Mantis, the Grasshopper, Musca, and an undetermined spider. The most complete observations were made upon the development of Thyridopteryx, where Dr. Bruce failed to find the centrolicithal segmentation described as characteristic of arthropod embryology, but rather a central segmentation, the blastoderm arising by a migration of the resulting cells to the surface of the yolk. In his interpretation of the origin of the endoderm the author agrees well with the Hertwigs, regarding the primitive groove as a blastopore, and the cells which rise from its bottom as a compound of mesoderm and entoderm. The neurulation is normal; but the author differs from Hatschek in regarding the inter-neural ectoderm as forming the migratory mesoderm rather than the transverse commissures of the nervous system. The supra-œsophageal ganglion consists of two portions,the anterior supplying the antennæ, the posterior the labrum, thus showing that the antennæ are clearly prestomial in position. The few observations made upon the ontogeny of the compound eyes throw but little light upon their origin.

In the Orthopterous forms the segmentation is much like that of spiders or Astacus, the result being the formation of yolk-pyramids, the yolk proper being free from nuclei at one period. Later, yolk-nuclei were seen, which are regarded as migrating from the blastoderm. The mesoderm arises from the median groove, not from the lateral thickenings. The maxillæ in the embryo are triramose.

In the fly, observations were recorded on the development of the egg and its maturation, Dr. Bruce regarding the yolk as arising from the breaking down of the epithelium of the outer end of the ovarian tube.

In the spider, Dr. Bruce found the invagination for the optic vescicles (*vide* Pl. vi., Figs. lxxx and lxxxi.); but he erred in calling it the amniotic fold, otherwise (as he published a preliminary paper in which this fold was mentioned) he might have anticipated Locy in his discovery. Some observations are recorded upon the formation of the pulmonary organs, but, from reasons not apparent in either figures or text, the author thinks that two appendages are concerned in the formation of each lung-book. It is, however, to be noted that his observations, so far as they go, show that the lung-books are in reality modified appendages, and support the hypo-

[1] Edited by Prof. Jno. A. Ryder, University of Penna., Philadelphia.
[2] Observations on the Embryology of Insects and Arachnids. By Adam Todd Bruce. Baltimore, 1887. 4to; 9x31x17 pp.; 7 plates and portrait.

thesis of Lankester of the homology of the lungs and tracheæ of spiders with the gills and gill-appendages of Limulus.

Among the conclusions which are drawn, the following are worthy of note. The yolk-cells of hexapods and spiders are regarded as the true endoderm, but their purpose is the digestion of the yolk. The functional endoderm is of later origin, and forms the epithelium of the digestive tract. Spiders and the Merostomata are allied to each other, and differ from other arthropods in the absence of antennæ. The tracheæ of hexapods and of spiders are not homologous; for in the one they are clearly modified appendages, while in the other they occur on segments where well-marked appendages exist.—*J. S. K.*

The Development of Crangon.—In continuing my studies of the ontogeny of Crangon, I find the following points worthy of presentation, apart from my complete paper, soon to be issued. The blastopore, contrary to my previous statement, never becomes completely obliterated, but persists, and later an in-pushing takes place from the same spot and gives rise to the proctodæum.

The anus is at first *dorsal* in position, and attains its ventral position later by an outgrowth of the telson.

In front of the anus are a number of large budding-cells, both ectodermal and mesodermal, and from these are budded off new cells, which give origin to the segments of the body. They contribute largely to the nervous system and myotomes, and in them occur the only cases I have seen of karyokinesis in Crangon. They may be compared with the mesoblasts and neuroblasts of the leech, as described by Dr. Whitman.

The alimentary tract proper is wholly of *ectodermal* origin, the proctodeal and stomodeal inpushings, giving rise to all of it. The endoderm of invagination forms first migratory yolk-cells, which metabolise the yolk, and, later, arrange themselves to form the epithelium of the so-called "liver" or mid-gut gland of Frenzel.

The green gland is of mesodermal origin, as maintained by Grobben, and not of ectodermal, as described by Reichenbach and Ishikawa. This allows of its comparison with the segmental organs of the annelids. These points will be fully illustrated in the complete paper.—*J. S. Kingsley, Bloomington, Ind.*

PHYSIOLOGY.[1]

NOTES ON THE PREPARATION OF NUTRIENT GELATINE AND AGAR.–The practical worker in Bacteriology deplores the loss of time usually attendant upon the preparation, and especially upon the filtration of nutrient gelatine and agar. The method formulated by Koch and closely followed by most workers, is very satisfactory in producing good, clear culture media, but a few modifications render the procedure a much less formidable one, and as the changes to be suggested are simply those of detail, it may be well to state in brief the method now in use in this laboratory, which after considerable trial gives uniform and satisfactory results.

One pound ($\frac{1}{2}$ kg.) of finely chopped beef, as free as possible from fat and gristle, is mixed with 1000 c. c. of distilled water and kept in a cool place for 12 or 18 hours. It is then strained, cold, through a coarse cloth, into a wide-mouthed "agate ware" or "enameled iron" vessel of sufficient size, and 5 gm. of C. P. sodium chloride, 10 gm. of pepton,[1] and 100 gm. of gelatine[2] (or 10 gm. of Agar) are added. This is then placed in a water bath[3] (to which a large handful of rock salt has been added, if agar is to be prepared) and the gelatine (or agar) melted as rapidly as possible. The fluid is then neutralized by the careful addition of sodium bicarbonate in solution, and the boiling continued for a few minutes after, in order to precipitate the phosphates.

The fluid is now cooled by running water, to such a temperature as will not coagulate the white of egg, yet not enough to solidify it, when the whites of two eggs, thoroughly beaten up are mixed with it, and the whole boiled for half an hour.

Filtration which has usually been effected by means of filter paper, can be much more rapidly performed by the use of *absorbent cotton in large quantity*. The pores of the paper become clogged by the fine precipitates and by the cooling of the medium, and even with the use of the "hot funnel" the filtration is sometimes very slow. Cotton, on the other hand, presents in its meshes a much larger surface for the entanglement of the fine precipitates, and when used in large quantity, allows the gelatine (or agar) even when not very hot, to flow through it rapidly. The preparation of the filter is as follows: The absorbent cotton is unrolled, and sterilized in bulk in the hot-air chamber, care being taken not to char it. A six-inch

[1] This department is edited by Prof. Wm. T. Sedgwick, of the Mass. Institute of Technology, Boston, to whom brief communications, books for review, etc., should be sent.

[2] *Comte fils Gelatine premiere qualite*, gives excellent results.

[3] *Pepton Sicc. Extra*, from G. A. Hesterberg, Berlin, is used, as it imparts no color.

[4] The form that has been found most convenient is known as an agate ware "Milk or Rice boiler."

(15 ctm.) glass funnel is packed full with the dry sterilized cotton, placed in in layers, in such a way as to keep it well out of the neck, and having no folds nor ridges of cotton next the glass, through which the precipitates might pass into the receiving flask.

The neutralized culture medium, after being boiled with the white of egg, as above described, is strained through coarse flannel into a flask, and poured slowly upon the centre of the filter until the cotton is thoroughly soaked, and the fluid begins to run into the flask below. This moistening causes the cotton to sink considerably, and packs it in the funnel, and when packed, the fluid filters through it almost as rapidly as it is poured into the funnel. The funnel is now filled and the fluid filtered as fast as it will run through. The first filtration seldom produces a clear medium, but through the same filter the fluid may be poured again and again, each time becoming clearer, and the moderate cooling which necessarily occurs, does not sensibly retard the rapidity of filtration. When filtration is completed, a considerable portion of the medium entangled in the filter can be saved, by pressing upon the cotton with a sterilized glass rod, gently at first and near the sides, then in the centre and with considerable force. The gelatine or agar pressed from the cotton is sometimes cloudy, for which reason it is well to catch it in a separate flask.

It not infrequently happens that gelatine which filters clear precipitates phosphates on boiling; and that agar, on cooling, forms a flocculent precipitate. To insure against filling tubes with such media, it is safest always to fill one tube with the medium, and by first cooling, then by boiling and again cooling, to test the permanence of the transparency obtained. Should these precipitates form, it will be necessary to boil the gelatine in the flask, and to refilter it through a small plug of dry cotton placed in a funnel; while agar should be allowed to completely solidify, when it is again melted and filtered through a small plug of cotton. The media are now ready for tubing and sterilizing in the usual way.

The large quantity of absorbent cotton used and the considerable amount of medium lost, by remaining entangled in the meshes of the cotton (this may amount to 200 c. c. for each of the large cotton filters employed) are unquestionably objections to this method of filtration, but in its favor it may be stated that one filter when properly packed, serves to clear a large quantity of medium, and the great saving of time in filtering, enables one to prepare a large amount of these nutrients at one operation, which may be stored for future use. Futhermore, the "hot funnel" is dispensed with.

The modifications here described may be best appreciated by the fact that they render it possible to prepare within three hours several litres of the above-mentioned culture media.—*T. M. Cheesman, Jr., M.D.* (From the Bacterial Laboratory of Alumni Association of the College of Physicians and Surgeons, New York City.)

PSYCHOLOGY.

THE MONKEY AS A SCIENTIFIC INVESTIGATOR.—In the very interesting little "zoo," which now forms quite an attractive department of the National Museum at Washington, there is a fine male grivet monkey (*Cercopithecus erythræa*), who shares a large cage with four opossums. Although he has a bad record as a fighter and biter of human beings, he takes kindly to his strange companions, and they have been the best of friends from the first. He spends many an hour in searching the fur of the opossums, and always sleeps with them in the family bed of straw. A few days ago the attention of the attendant was drawn to the monkey cage by the excited behavior of the crowd in front of it, and on going to ascertain the cause a strange and ludicrous sight was revealed to his astonished gaze.

In the middle of the cage sat the monkey, holding one of the opossums in his lap, with her belly uppermost, and her head under his arm. She submitted quite passively, far more so than when the attendants had previously made a similar examination. The monkey had just discovered the marsupial pouch of the opossum, and was diligently investigating it. Had he not been a close observer it certainly would have remained unseen, for it was so tightly closed as to be perfectly invisible in its normal condition. The monkey carefully lifted the outer wall of the pouch, and peered into the cavity. Then he reached in with his hand, felt about for a moment, and to the astonishment of everybody took out a tiny young opossum, about two inches long, hairless, blind, and very helpless, but alive and kicking. Jock held it up to the light, where he could get a good view of it, scrutinized it with the air of a savant, and presently returned it to the pouch, very carefully. After replacing it he looked into the pouch again, and presently drew out another for examination, which he looked at with solemn interest, smelled of it, and then carefully put it back. It was thus it became known to the attendants that the old female opossum had the young ones, which had previously been looked for in vain. —*W. T. Hornaday.*

ARCHÆOLOGY AND ANTHROPOLOGY.[1]

The Anthropological Society of Washington held its 138th regular meeting May 1st. Mr. W. H. Holmes, who has divided his talents about equally between science and art and been successful in both, read a paper entitled "Some Primitive Phases of Æsthetic Development." He directed his remarks principally to art in American prehistoric pottery. He said these earthen vessels were the outgrowth of natural form, finally acquiring decoration. This pottery was originally moulded in a basket or wicker-work (having the appropriate shape), thus giving to the soft clay the impressions of the woven meshes. When the vessel was burned these formed the decoration. This method of decoration seems to have been afterwards replaced by another, in which the cloth or wicker-work was either wrapped about or its figure cut into a wooden mould or form which was pressed on the outside of the vessel. A notched wheel was sometimes used. Some of the decorated vessels were shown, as well as some of the paddles used. These were, however, all modern Indian work.

Another paper was by Dr. W. J. Hoffman, on "Pictography and Shamanistic Rites of the Ojibwa." This tribe belongs to Minnesota. It has three distinct secret societies. The Grand Medicine Lodge is the most important. Each lodge has a high priest, who is charged with the preparation of candidates. There are four degrees. The rites occur in the spring, and the winter months are passed in study and preparation for the initiation. In addition to the practice of medicine the candidate must be instructed in the meaning of the characters on the sacred charts. The candidates who pass the four degrees are supposed to be gifted with the power of prophecy, of curing disease, and of prolonging life. Those who take but one degree usually manufacture the fetishes. Dr. Hoffman presented a number of original charts, not the sacred ones, from this tribe, showing the use of the characters, their meaning, and the method of translation. He also exhibited enlarged copies of charts which he had copied, sometimes surreptitiously, while among these Indians.

GUAJIRO is, according to Dr. A. Ernst, of Carácas, the correct form of the name of the Guajiro Indians inhabiting the South American peninsula called after them. In 1870 that explorer published his treatise on the Guajiro Indians in the *Zeitschrift für Ethnologie*, and since then their language, customs, and social institutions have been explored and described by various authors. From manuscripts of the United States consul Plümacher, at

[1] This department is edited by Thomas Wilson, Esq., Smithsonian Institution, Washington, D. C.

Maracaibo, a sketch of their customs and sociology was published in 1888.[2] Before this, Rafael Celedon, director of the seminary at Santa Marta, wrote a grammar of the language, which was published by E. Uricoechea in Maisonneuve & Co.'s Linguistic Collection, Paris, 1888. In an appendix to that treatise, Uricoechea reproduced Ernst's vocabulary of Guajiro *without giving credit to the author* for it. Celedon's work was regarded as insufficient in several respects by Don Jorge Isaacs, who published his critical remarks and strictures in the *Estudio del lenguaje Guajiro.*[2] Ernst regards that treatise as a valuable contribution to the knowledge of these South American dialects. Celedon, however, asserted his position, and defended himself against Isaacs's strictures in another article of the same *Anales*, entitled *Gramatica Guajira*, 1887, pp. 491–515. It seems to us that these attacks were victoriously warded off in part, and no student of that language must fail to read the writings of both antagonists. Both are placing the Guajiro language among the Carib dialects, to which it undoubtedly belongs. Ernst himself expresses the opinion "that this tribe forms a fragment of the scattered Arrowak, or Aruak ethnic family, linguistically as well as anthropologically." He states that the word Guajiro also occurs on the island of Cuba, the farmers being called by this name there from guayu, *we* (in Arawak wáyu) in the Guajiro language. It is impossible to make a full extract of Ernst's valuable article, and we have to refer our readers to the paper itself. Celedon has recently published materials upon the Köggaba language, which is distantly related to Guajiro (Paris: Maisonneuve & Co., 1886), and spoken in the Sierra Nevada of Santa Marta.—*A. S. Gatschet.*

Contributions to Anthropology and Prehistorics of Bavaria.—The latest number of this celebrated periodical,[1] which is published by the Munich Society of Anthropology, does not lag behind its predecessors in elaborateness and scientific importance. The curious subterranean gangways and corridors, which occur in a large portion of Würtemberg, Bavaria and Austria, were first explored and described between 1830 and 1840. Among the rustics many fairy and hobgoblin tales circulate on their account, these spirits being called *Erdleutl*, *Erdweibl*, *Schratzeln*, *Ratzeln*, *Wichtelen*, *Alraune*, *Weiberl*, and many other names, and represented as industrious and very bashful little beings. Some of these corridors take their starting-point from old castles, churches, mansions and their cellars, even from buildings now used as breweries, and parson's dwellings. Dr. Aug. Hartmann has published his results on this part of archæology in the exhaustive article "Unterrdische Gänge," pp. 93–129, stating that many other investigators are now engaged on this subject, and expect to publish their results in due time. Major C. Popp describes the Roman *castellum*, which formerly stood on a height near Pfünz, on the Altmühl River,

[1] Ausland of Stuttgart, January, 1888.

Bavaria.[1] Julius Naue continues his instructive enumeration of collective tombs or ancient cemeteries discovered between the Ammer and the Staffelsee, Bavaria. They all belong to the bronze and iron periods, and many of them are Roman. Some walls found near Uffing are of the cyclopean type and built of undressed stones. About thirty stone-graves are represented in the illustrations, many of them showing the body *in situ*. A physician of Tölz, Dr. M. Höfler, has composed a statistic memoir on "Cretinistic Changes observed with the Living Population of the District of Tölz," pp. 207–257. All cretinistic dispositions and alterations are deduced by the author from climatic causes. Among the characteristics of cretinism various authors are enumerating the pug-nose, prognathism, great distance from one eye to the other, bad condition of the teeth, small stature, lateness of the puberty period, weakness of the vocal and auditory organs, imbecility, goître, struma and scrofula. The geological formations which show the largest number of strumous individuals residing upon them are all of *marine* origin, as marine sandstone, eocene, keuper with marine shells. A map of the district, which lies upon the Isar River, is added to show the dissemination of the population affected with strumous diseases and complications.—*A. S. Gatschet.*

Folk-lore—How the Lizards were once Little Men. Mr. L. L. Frost, of Susanville, Lassen Co., California, tells us how, when he requested an Indian to gather and bring in all the arrow-points he could find, the Indian declared them to be "no good," that they had been made by the lizards. Whereupon Mr. Frost drew from him the following lizard story:

There was a time when the lizards were little men, and the arrow-points which are now found were shot by them at the grizzly bears. The bears could talk then and would eat the little men whenever they could catch them. The arrows of the little men were so small that they would not kill the bears when shot into them, and only served to enrage them. At last there was a smart little fellow who lived with his grandmother. One day he was making a bow and his grandmother asked him what he was going to do with it. He replied that he was going to kill a bear. His grandmother told him the bear had killed all his family, and so she refused her consent for him to go hunting, and kept him prisoner in the *campooda*. But the boy knew of a valley near by to which the bears came every evening to feed. He had finished his bow and gathered up his arrows, and when one day his grandmother went for water he stole away to this valley, and, climbing a tree, waited for events. Pretty soon a number of bears came into

[1] Anales de la Instruccion publica, Bogotá, 1884, vol. VIII., pp. 178–352, especially pp. 216–241.

[2] Vol. VII., Nos. 3, 4, illustrated.

[3] The name Pfünz is evidently derived from Lat. *pons* or *ad pontem*, "at the bridge," though the author is silent on this point.

the valley, and the little fellow whistled. At this the big boss bear which had killed so many of the little men, and of which all were afraid, came under the tree, and sitting himself on his haunches, looked up and asked the little fellow what he was doing up there. To which the little fellow replied, that he was going to kill him, the big boss bear. This reply tickled the bear so that he began to laugh, and making a great guffaw, opened his mouth so wide that the little fellow could see far down his throat, when quick as lightning he drew his bow and shot one of his arrows with one of these little points on it down the open throat of the bear and into his vitals, whereupon his laugh turned into a roar as he fell down, rolled over, and died. All the rest of the bears took to their heels and scampered up the valley and over the mountains. The little fellow went home and related what he had done, but his grandmother refused to believe him. But the next day the whole settlement gathered to hear the story, and all hands going to the valley, found the dead bear. This made the little fellow a great hero. Ever since that time the bears have hid away in the brush, and are afraid of men. Thus they have lost their power of speech.

The Indian could not tell how the little men became transformed into lizards.

SCIENTIFIC NEWS.

—Professor Amos H. Worthen, State Geologist of Illinois, and Curator of the State Museum of Natural History, died on Sunday, May 6th, 1888, at his home in Warsaw, Illinois, of pneumonia, at the age of nearly seventy-five years. For over thirty years he had been constantly engaged in the survey of, and in writing and publishing the reports upon the geology of his adopted State. He was born at Bradford, Vermont, October 31st, 1813. He was the son of Thomas Worthen, his mother being an Adams of Revolutionary and Presidential stock, and he was the youngest, save one, of a large family of thirteen children. He received his education in the common schools of his native town, and at Bradford's then famous academy. At an early age, before arriving at his majority, he married, January 14th, 1834, Miss Sarah Kimball, of Warren, New Hampshire, whose death occurred a little over a twelve-month ago. He emigrated to Kentucky in August, 1834, and in June, 1836, removed to Warsaw, Illinois, where he made his permanent home. With his brothers-in-law, the Kimball boys, or one of them, he became first a forwarding and commission merchant, and later dealt in dry goods at Warsaw. In 1842, influenced by the depression in business caused by the Mormon difficulties in Hancock county, he removed with his family to Boston, Massachusetts, returning in July, 1844, to Warsaw. Before going to Boston

his attention had been strongly attracted to the geological features of his new home, and the living forms preserved in the sedimentary rocks of that region, and especially its geode beds had commanded his admiration and close investigation. He gathered and took with him to Boston several barrels of "geodes," and there exchanged them for a cabinet of sea-shells, which he brought back with him to Warsaw. Similar forms to these shells he saw everywhere preserved in the limestone rocks of his locality, and every spare hour found him with his hammer and satchel exploring the ravines and bluffs and every exposure that could be reached. His collection grew apace, and soon began that extensive system of exchanges with other scientists which early made his collection so valuable as to command the attention of Professor Hall, geologist, first of New York and then of Iowa, and he secured from Professor Worthen the loan of many of his specimens with which to illustrate the first volumes of his reports on the geology of Iowa, the palæontology of which he placed in charge of Professor Worthen. Prior to this time, in February, 1851, a law had been passed authorizing a geological survey of Illinois, and two years later an appropriation was made for the purpose of carrying it out, and Professor Norwood was appointed geologist. Professor Worthen did some work under him, but soon engaged in more active work in Iowa under Professor Hall. On March 22d, 1858, Governor William H. Bissell, of Illinois, placed in the hands of Professor Worthen his commission as State Geologist, nothing of prior work coming to his hands except a report by Professor Norwood on the lead mines of Hardin county, and the field notes of his assistants. On taking charge of the survey, Professor Worthen at once proceeded to those active labors in the field which resulted in the publication of the magnificent series of eight quarto volumes of reports which are well known wherever geology is studied. He was assisted in this work especially by Professor J. D. Whitney in mineralogy, Professor Leo Lesquereux in coal measures and coal plants, Professor F. B. Meek, Mr. O. St. John, and Dr. John S. Newberry in different departments of palæontology, Dr. J. V. Z. Blaney in Analysis, and Mr. Henry Engleman first in detailed county surveys, and later in the chemistry of the survey. Professor Worthen's son, C. K. Worthen, aided greatly by furnishing the drawings for the numerous admirable engravings which so fully illustrate the reports. Professor Worthen was a man highly esteemed by all who knew him for many admirable qualities. He left six sons and twenty-two grandchildren.

—George F. Atkinson, Professor of Entomology and General Zoology in the University of North Carolina, has been appointed Professor of Botany and Zoology in the University of South Carolina, and *ex officio* Botanist and Entomologist to the State Experiment Station. His address after September 1st will be Columbus, S. C.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

INDIANA ACADEMY OF SCIENCE, MAY 1 TO 4, 1888. — The Academy held a field meeting at Wyandotte Cave, some thirty-five members attending. The party gathered at Paoli on the evening of the first, when papers were read by Mr. James E. Humphrey, of Indiana University, upon Asa Gray, and by Dr. John M. Coulter, of Wabash College, upon the Discovery of the Yellowstone Park. From Paoli a wagon ride of thirty miles brought the party to the cave. On the return trip the newly-discovered Marengo Cave was visited, which all agreed was superior in all except extent to Wyandotte Cave. It was the universal opinion of the Academy that the accommodations and table of the Wyandotte Cave Hotel cannot be too strongly criticised.

BIOLOGICAL SOCIETY OF WASHINGTON, APRIL 7, 1888. —The following communications were read: — Capt. J. W. Collins, "The Work of the Schooner Grampus, in Fish Culture;" Mr. Chas. D. Walcott, "Cambrian Fossils from Mount Stephens, Northwest Territory of Canada;" Prof. C. V. Riley, "Some notes from Emin Pasha's Travels in Central Africa;" Dr. Theobald Smith, "The Destruction of Pathogenic Bacteria in the Animal Organism."

APRIL 21, 1888.—Mr. F. W. True," The Affinities of the White Whale;" Dr. C. Hart Merriam, "A Bat new to the United States, and New Localities for other North American Mammals;" Prof. C. V. Riley, "Notes on Platypsyllus."

MAY 5, 1888.—Prof. R. E. C. Stearns," Instances of Mutations in Specific Distribution among Shells;" Mr. C. L. Hopkins, "Notes upon Pollenation of the 'Navel' Oranges;" Dr. C. Hart Merriam, "Description of a New Meadow Mouse, with remarks on the Subgenus Pedomys;" Prof. Lester F. Ward, "On some Characteristics of the Flora of the Potomac Formation."

MAY 19, 1888.—Mr. F. W. True, "The Hawaiian Bat"; Mr. Wm. T. Hornaday, "Man-Eating Crocodiles"; Dr. C. Hart Merriam, "A Revision of the *Dipodidæ*"; Mr. F. A. Lucas, "The Affinities of *Chamæa*."

BOSTON SOCIETY OF NATURAL HISTORY. — April 4, 1888. — Mr. Samuel Wells read a notice on the Life of the late Richard C. Greenleaf; Mr. Robert T. Jackson read a paper on "The Development of the Oyster, with Remarks on Allied Genera."

APRIL 18, 1888. — Professor Alpheus Hyatt read a sketch of the life of the late Spencer F. Baird, and Dr. Charles Sedgwick Minot exhibited the new automatic microtome which he has invented and which has now been placed on the market. The committee on nominations of officers for the year 1888–89 was presented and accepted.
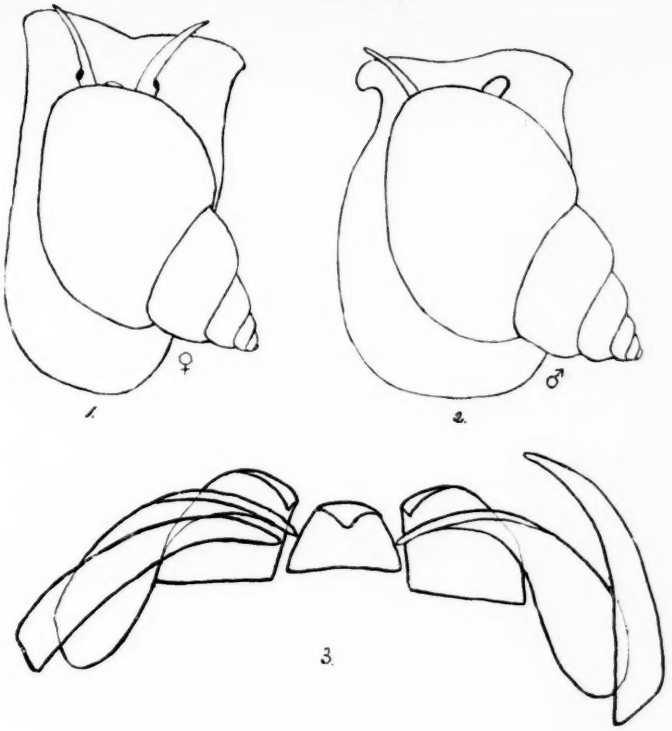
PLATE VII.